55-1520-228-10

TM 55-1520-228-10

TECHNICAL MANUAL

OPERATOR'S MANUAL
ARMY MODEL OH-58A/C HELICOPTER

This copy is a reprint of the basic.

This manual supersedes TM 55-1520-228-10 and TM 55-1520-235-10, 7 April 1978, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY

17 JANUARY 1989

D 101.11:

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Reproduced from poor document.

WARNING

Personnel performing operations, procedures and practices which are included or implied in this technical manual shall observe the following warnings. Disregard of these warnings or precautionary information can cause serious injury or loss of life.

STARTING ENGINE

Coordinate all cockpit actions with ground observer. Ensure that rotors and blast areas are clear and fire guard is posted, if available.

FIRE EXTINGUISHER

Exposure to high concentrations of monobromotribluoromethane (CF Br) extinguishing agent or toxic fumes produced by the agent should be avoided. The liquid should not be allowed to come into contact with the skin, as it may cause frostbite or low temperature burns.

GROUND OPERATION

Engines will be started and operated only by authorized personnel. Reference AR 95-1.

ELECTROLYTE

Battery electrolyte is harmful to the skin and clothing. Neutralize any spilled electrolyte by flushing contacted areas thoroughly with water.

CARBON MONOXIDE

When smoke, suspected carbon monoxide fumes, or symptoms of anoxia exist, the crew should immediately ventilate cabin and shut off heater.

HANDLING FUEL AND OILS

Turbine fuels and lubricating oil contain additives which are poisonous and readily absorbed through the skin. Do not allow them to remain on skin longer than necessary.

HANDLING HYDRAULIC FLUID (MIL-H-83282)

Prolonged contact with liquid or mist can irritate eyes and skin. After prolonged contact with skin, immediately wash contacted area with soap and water. If liquid contacts eyes, flush immediately with clear water. If liquid is swallowed, do not induce vomiting; get immediate medical attention. Wear rubber gloves when handling liquid. If prolonged contact with mist is likely, wear an appropriate respirator. When fluid is decomposed by heating, toxic gasses are released.

HAZARDOUS CARGO

Items of cargo possessing dangerous physical properties, such as explosives, acids, flammable, etc., must be handled with extreme caution and in accordance with established regulations. Refer to TM 38-250.

NOISE

Sound pressure levels in this aircraft during some operating conditions exceed the Surgeon General's hearing conservation criteria as defined in TB MED 501. Hearing protection devices, such as the aviator helmet or earplugs are required to be worn by all personnel in and around the aircraft during its operation.

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

User Information. The proponent agency of this manual is the US Army Aviation Systems Command (AVSCOM). Submit changes for improving this publication on DA Form 2028 (Recommended Changes to Publications and Blank Forms) through the aviation unit commander to US Army Aviation Systems Command, (AVSCOM), ATTN: AMSAV-MMD, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798.

Types of comments that should be avoided on DA Form 2028 are those that: (1) Ask a question instead of giving an answer; (2) Are based on minor differences of opinion or wording; (3) Point out obvious editorial errors, misspellings, or errors in punctuation, unless the errors change the intended meaning. (Reference AR 310-3, Chapter 1).

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CHAPTER 1

INTRODUCTION

1-1. GENERAL.

These instructions are for use by the operator. They apply to Army OH-58A/C Helicopters.

1-2. WARNING, CAUTIONS, AND NOTES DEFINED.

Warnings, cautions, and notes are used to emphasize important and critical instructions and are used for the following conditions:

WARNING

An operating procedure, practice, etc., which if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc., which, if not strictly observed, could result in damage to or destruction of equipment.

NOTE

An operating procedure, condition, etc., which it is essential to highlight.

1-3. DESCRIPTION — MANUAL.

This manual contains the complete operating instructions and procedures for the Army OH-58A/C helicopter. The primary mission of this helicopter is that of observation and is designed for landing and take off from prepared and unprepared surfaces. The observance of procedures is mandatory except when modification is required because of multiple emergencies, adverse weather, terrain, etc. Your flying experience is recognized, and therefore, basic flight principles are not included. It is required that THIS MANUAL BE CARRIED IN THE HELICOPTER AT ALL TIMES.

1-4. APPENDIX A, REFERENCES.

Appendix A is a listing of official publications cited within the manual applicable to and available for flight crews.

1-5. INDEX.

The index lists, in alphabetical order, every titled paragraph, figure (F), and table (T) contained in this manual. Chapter 7 performance data has an additional index within the chapter.

1-6. ABBREVIATIONS.

Designator symbols and abbreviations shall be used in conjunction with text contents, headings, and titles to show effectivity of the material. Chapter 7 contains a list of abbreviations used in this publication.

1-7. ARMY AVIATION SAFETY PROGRAM.

Reports necessary to comply with the safety program are prescribed in AR 385-40.

1-8. DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE.

For information concerning destruction of Army materiel to prevent enemy use, refer to TM 750-244-1-5.

1-9. FORMS AND RECORDS.

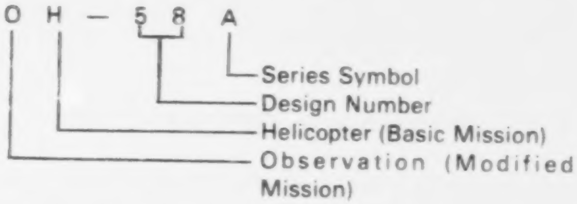
Army aviators flight record and helicopter maintenance records which are to be used by crewmembers are prescribed in DA PAM 738-751 and TM 55-1500-342-23.

1-10. HELICOPTER DESIGNATION SYSTEM.

The designation system prescribed by AR70-50 is used in helicopter designations as follows:

EXAMPLE OH-58A

The designation system prescribed by AR70-50 is used in helicopter designations as follows:



1-11. DESIGNATOR SYMBOLS.

Designator symbols A OH-58A and C OH-58C are used in conjunction with text contents, text headings and illustration titles to show limited effectivity of the material. One or more designator symbols may follow a text heading or illustration title to indicate proper effectivity, unless the material applies to all series and configurations within the manual. If the material applies to all series and configurations, no designator symbols will be used. Where practical, descriptive information is condensed and combined for all models to avoid duplication.

1-12. USE OF WORD SHALL, SHOULD, AND MAY.

Within this technical manual the word "shall" is used to indicate a mandatory requirement. The word "should" is used to indicate a nonmandatory but preferred method of accomplishment. The word "may" is used to indicate an acceptable method of accomplishment.

CHAPTER 2

HELICOPTER AND SYSTEMS DESCRIPTION AND OPERATION

SECTION I. HELICOPTER

2-1. GENERAL.

The OH-58A/C helicopter (figure 2-1 **A** and figure 2-2 **C**) is a single engine, observation type helicopter designed for landing and takeoff from prepared or unprepared surfaces. The fuselage consists of the forward section, intermediate or transition section, and the aft or tailboom section. The forward section provides the cabin and fuel cell enclosure as well as pylon support. Entrance to the cabin is provided by two doors on each side. The pilot station (figure 2-3 **A** and figure 2-4 **C**) is located on the right and the copilot/observer station is located on the left side of the helicopter. The area aft of the pilot and copilot may be used as a cargo/passenger compartment. It also provides support for the M27E1 armament system **A**. The intermediate section supports the engine and includes the equipment and electronic compartment. The tailboom supports the horizontal stabilizer, vertical stabilizer, and tail rotor. The basic structure of the forward section consists of a lower-curved honeycomb sandwich panel and an upper longitudinal aluminum beam. The core of the sandwich structure is aluminum alloy throughout. The faces are aluminum alloy except in the fuel cell region, where they are fiberglass. The aluminum alloy sandwich panel is capable of withstanding the specified design cargo loadings, while the fiberglass sandwich supports the fuel cell pressures. The rotor, transmission, and engine are supported by the upper longitudinal beam. The upper and lower structures are interconnected by three fuselage bulkheads and a centerpost to form an integrated structure. The most forward and aft bulkheads act as carry-through structure for the skid landing gear crosstubes. The tailboom is a monocoque structure with aluminum skin and aluminum substructure.

a. **Dimensions.** Principal dimensions of the helicopter areas are shown in figure 2-5.

b. **Turning Radius and Ground Clearance.** (Refer to figure 2-6.)

c. **Weights.** The helicopter weight empty and gross operating weight will change according to the configuration or equipment installed for the type of mission to be performed. Refer to Chapter 6, Weight/Balance and Loading.

d. **Crew Configuration.** The crew consists of the pilot alone, pilot and copilot, pilot and gunner **A**, or pilot and observer.

2-2. PASSIVE DEFENSE.

The armor protection is a combination of ceramic and fiberglass composite with a small amount of dual hardness steel. The armor protection is removable.

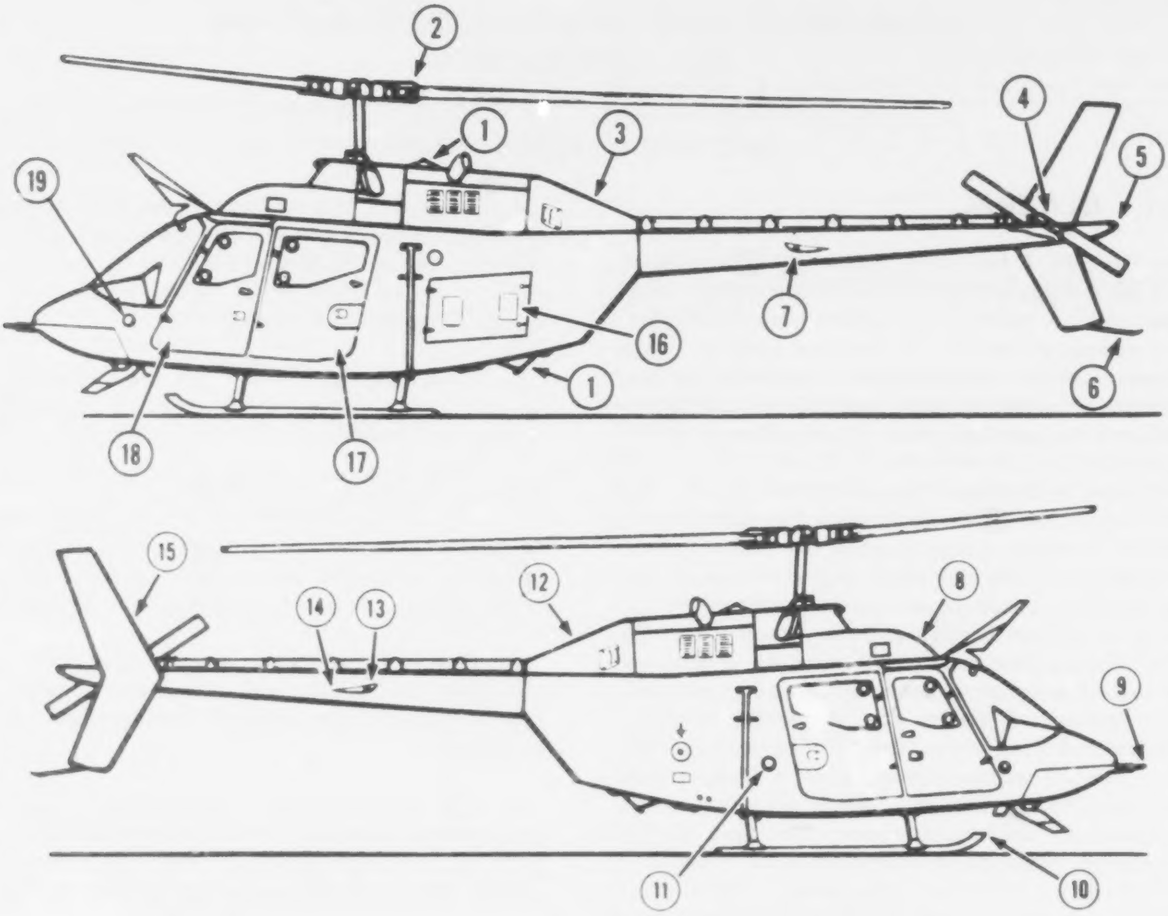
a. **Crew Protection.** Armor protection is furnished for the pilot and copilot and consists of panels on seat bottom, seat back, and outboard side of each seat.

b. **A** **Component Protection.** Armor protection is furnished for the compressor section of the engine and consists of a panel on each side of the engine. The fuel lines and oil cell are self sealing.

2-3. LANDING GEAR SYSTEM.

a. **Standard System.** The landing gear system is a skid type, consisting of two laterally mounted arched crosstubes, attached to two formed longitudinal skid tubes. The landing gear structure members are made from formed aluminum alloy tubing with steel skid shoes to minimize skid wear. The gear assembly is attached with straps/clamps at four points to the fuselage structure, therefore, gear removal for maintenance can easily be accomplished. The manually retractable and quickly removable wheel assemblies have been provided to facilitate helicopter ground handling operations.

b. **High Skid Gear.** The high skid gear, when installed, will provide an approximate additional 14



1. Anti-Collision Light
2. Main Rotor Hub and Blades
3. Engine Oil Tank Drain Access Door
4. Tail Rotor Hub and Blade
5. Position Light (White)
6. Tail Skid
7. Position Light (Red)
8. Forward Transmission Fairing
9. Pitot Tube
10. Skid Gear
11. Fuel Filler Cap
12. Aft Engine Cowling
13. Position Light (Green)
14. Horizontal Stabilizer
15. Vertical Fin
16. Battery and Avionics Compartment Door
17. Passenger Door (Left)
18. Copilot Door
19. Left Static Port

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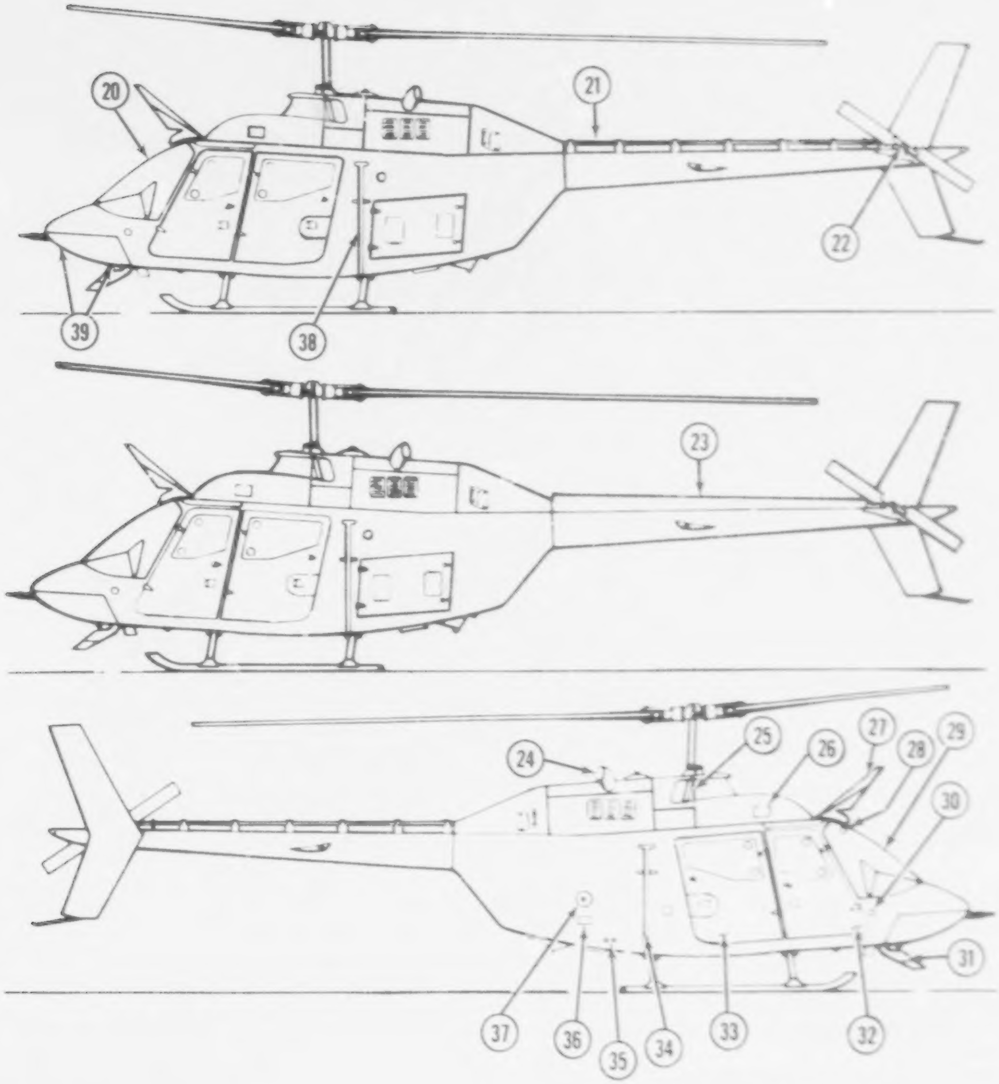
Figure 2-1. General Arrangement A (Sheet 1 of 2)



20. Windshield
21. Tail Rotor Driveshaft
22. Tail Rotor Gearbox
23. Tail Rotor Driveshaft and Cover (if installed)
24. Engine Exhaust
25. Engine Air Inlet
26. Forward Transmission Fairing Inspection Door
27. Upper Cutter Assembly
28. Free Air Temperature (FAT) Gage
29. Windshield Deflector/Cutter Assembly
30. Right Static Port
31. Lower Cutter Assembly
32. Pilot Door
33. Passenger Door (Right)
34. FM Homing Antenna (Right Side)
35. Battery Vent
36. External Power Receptacle
37. Ground Receptacle
38. FM Homing Antenna (Left Side)
39. Landing Lights

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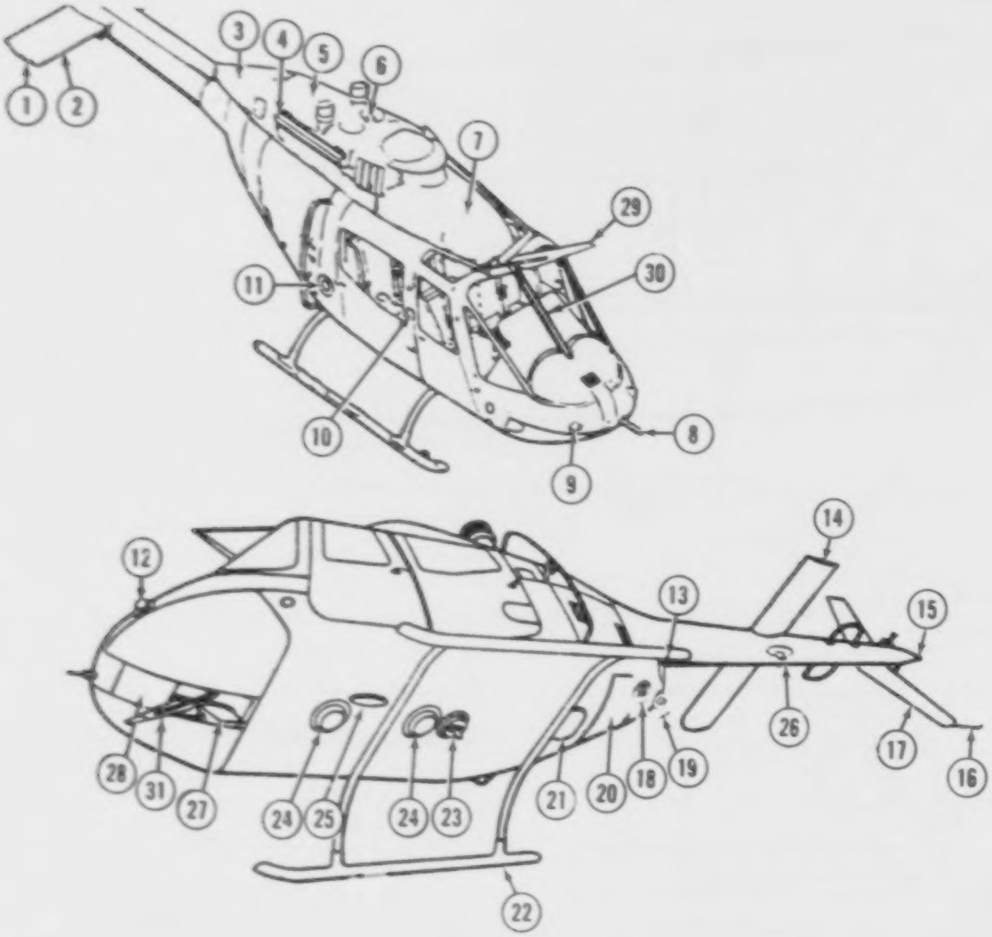
Figure 2-1. General Arrangement **A** (Sheet 2 of 2)



1. Position Light (Green)
2. Horizontal Stabilizer
3. Engine Oil Tank Cowling
4. Infrared Suppression Shield
5. Aft Engine Cowling
6. Upper Anti-Collision Light
7. Forward Transmission Fairing
8. Pitot Tube
9. Right Forward Radar Warning Antenna
10. Door Lock
11. Fuel Filler Cap
12. Left Forward Radar Warning Antenna
13. Left Aft Radar Warning Antenna
14. Position Light (Red)
15. Position Light (White)
16. Tail Skid
17. Vertical Fin
18. Lower Anti-Collision Light
19. Aft Proximity Warning Antenna
20. ADF Sense Antenna
21. ADF Loop Antenna
22. Landing Gear
23. Radar Warning Blade Antenna
24. Radar Altimeter Antenna
25. Marker Beacon Antenna
26. Transponder Antenna
27. UHF Antenna
28. Landing Light
29. Upper Cutter Assembly
30. Windshield Deflector/Cutter Assembly
31. Lower Cutter Assembly

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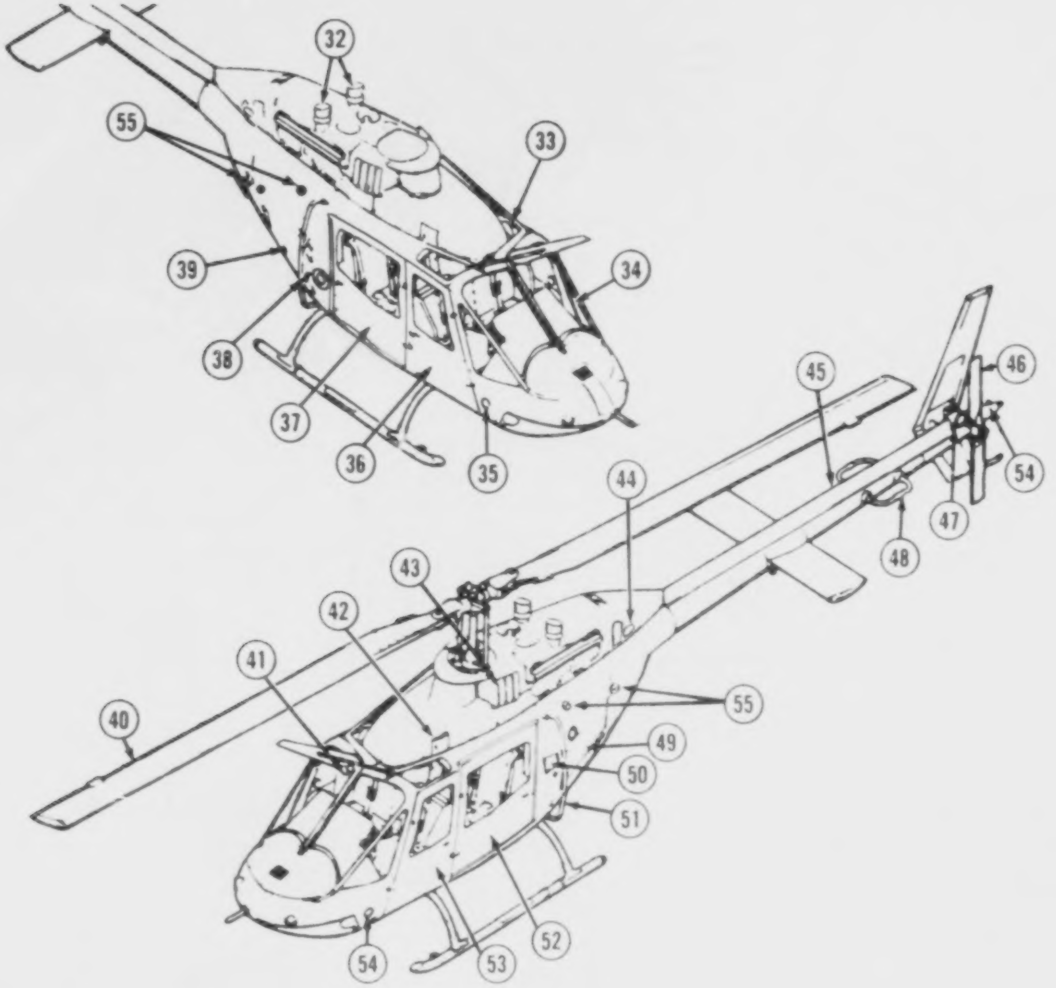
Figure 2-2. General Arrangement C (Sheet 1 of 2)



32. Infrared Engine Exhaust
33. FM No. 2 Antenna
34. Windshield (Flat Glass)
35. Right Static Port
36. Pilot Door
37. Cabin Door
38. Battery Vent
39. External Power Receptacle
40. Main Rotor Blades and Hub
41. Free Air Temperature (FAT) Gage
42. Forward Transmission Fairing Inspection Door
43. Engine Air Inlet
44. Engine Oil Tank Drain Access Door
45. Tail Rotor Driveshaft Cover
46. Tail Rotor Blade and Hub
47. Tail Rotor Gearbox
48. VOR Antenna
49. Battery and Avionics Compartment Door
50. Step
51. FM Homing Antenna
52. Cabin Door
53. Copilot/Observer Door
54. Left Static Port
55. NVG Position Lights

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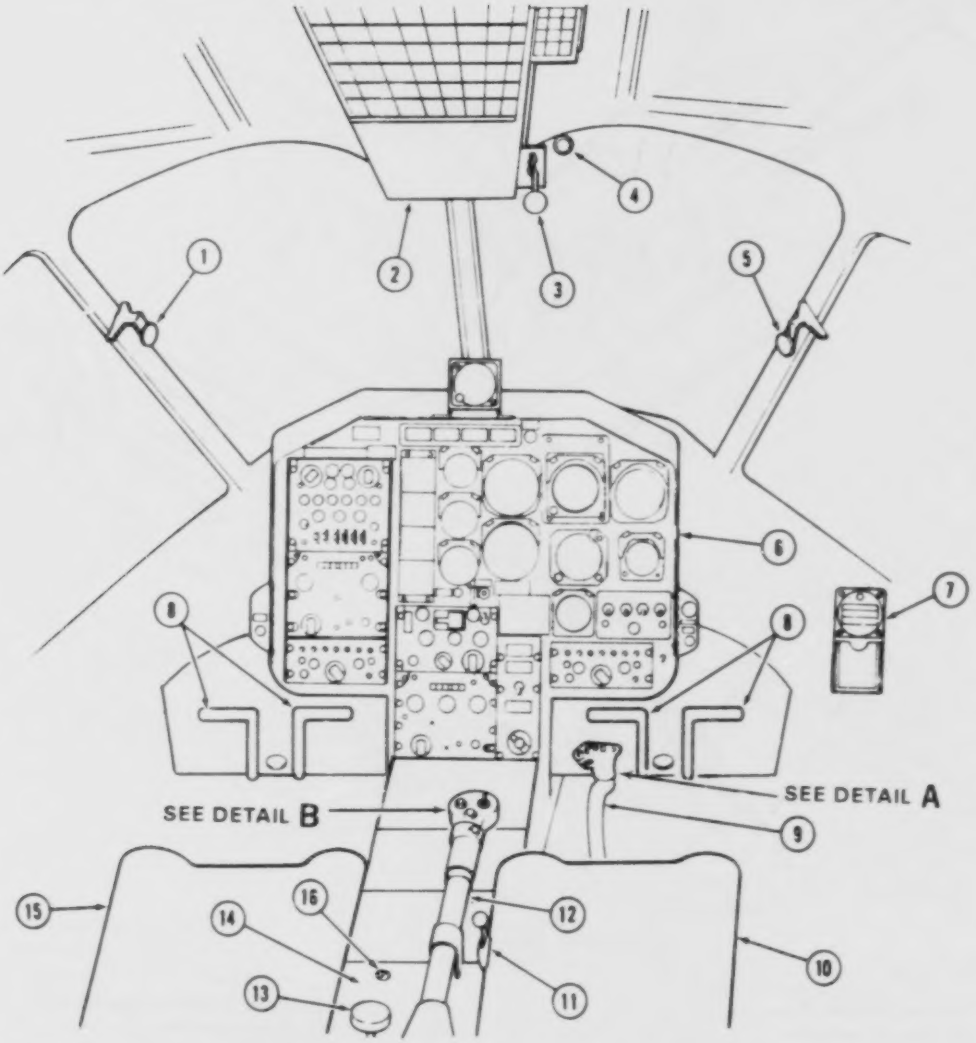
Figure 2-2. General Arrangement **C** (Sheet 2 of 2)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SEE DETAIL A
SEE DETAIL B
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1. Copilot Door Emergency Jettison Handle
2. Overhead Console
3. Fuel Shutoff Valve
4. Free Air Temperature (FAT) Gage
5. Pilot Door Emergency Jettison Handle
6. Instrument Panel
7. Magnetic Compass
8. Anti-Torque Pedals
9. Pilot Cyclic Stick
10. Pilot Seat
11. Inertia Reel Control Handle
12. Pilot Collective Stick
13. Collective Friction Control Adjustment
14. Pedestal
15. Copilot Seat
16. Ignition Key Lock Switch

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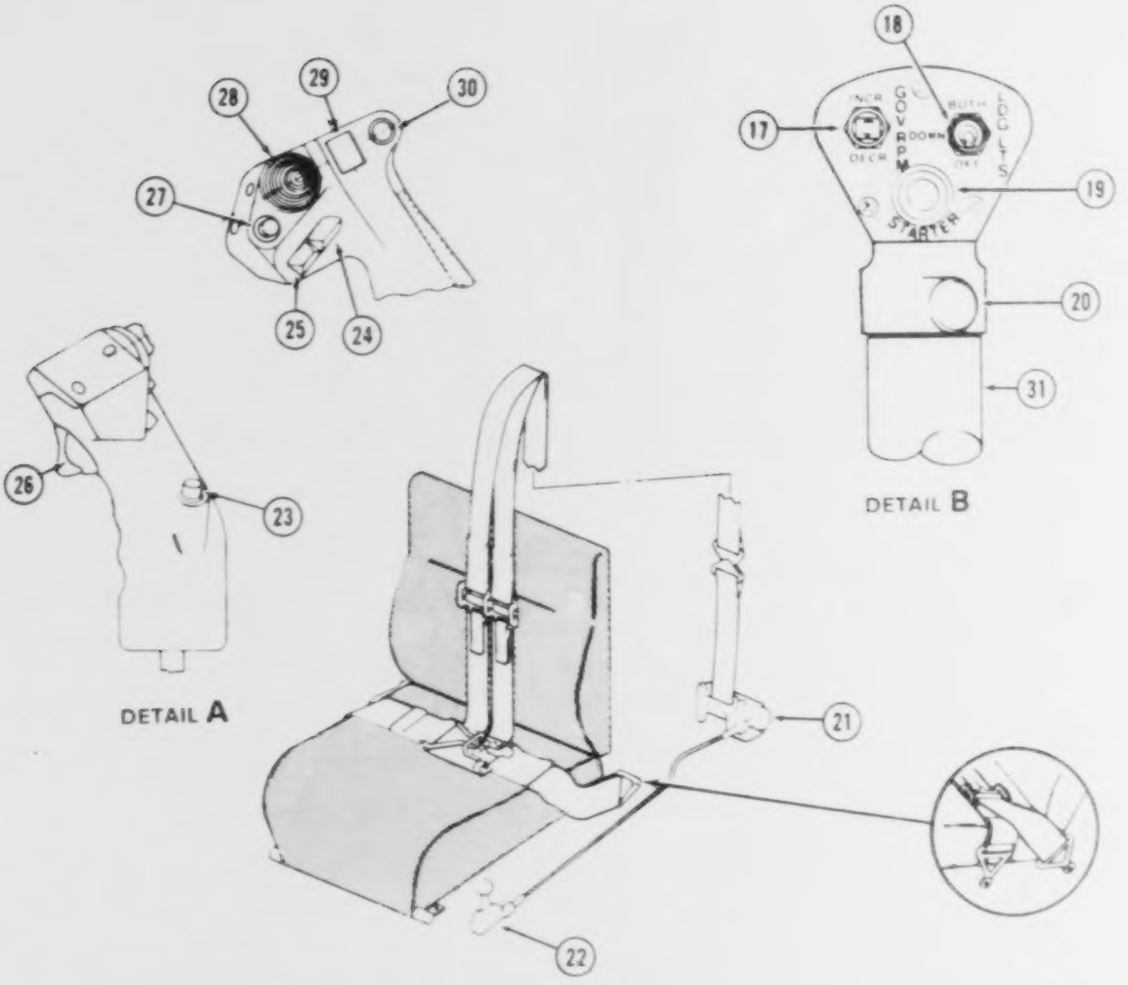
Figure 2-3. Compartment Diagram A (Sheet 1 of 2)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30
17
INCR
DECR
GOV RPM
DOWN
BOTH
OFF
LDG LTS
19
STARTER
27
20
25
24
31
26
23
DETAIL B
DETAIL A
21
22

17. Goveror Switch
18. Landing Lights
19. Starter Switch
20. Engine Idle Release Control
21. Inertia Reel
22. Inertia Reel Control Handle
23. Not Used
24. ICS Switch
25. Radio Transmit Switch
26. Trigger Switch
27. Not Used
28. Not Used
29. Depress/Elevate Gun Switch
30. Force Trim Release Switch
31. Throttle

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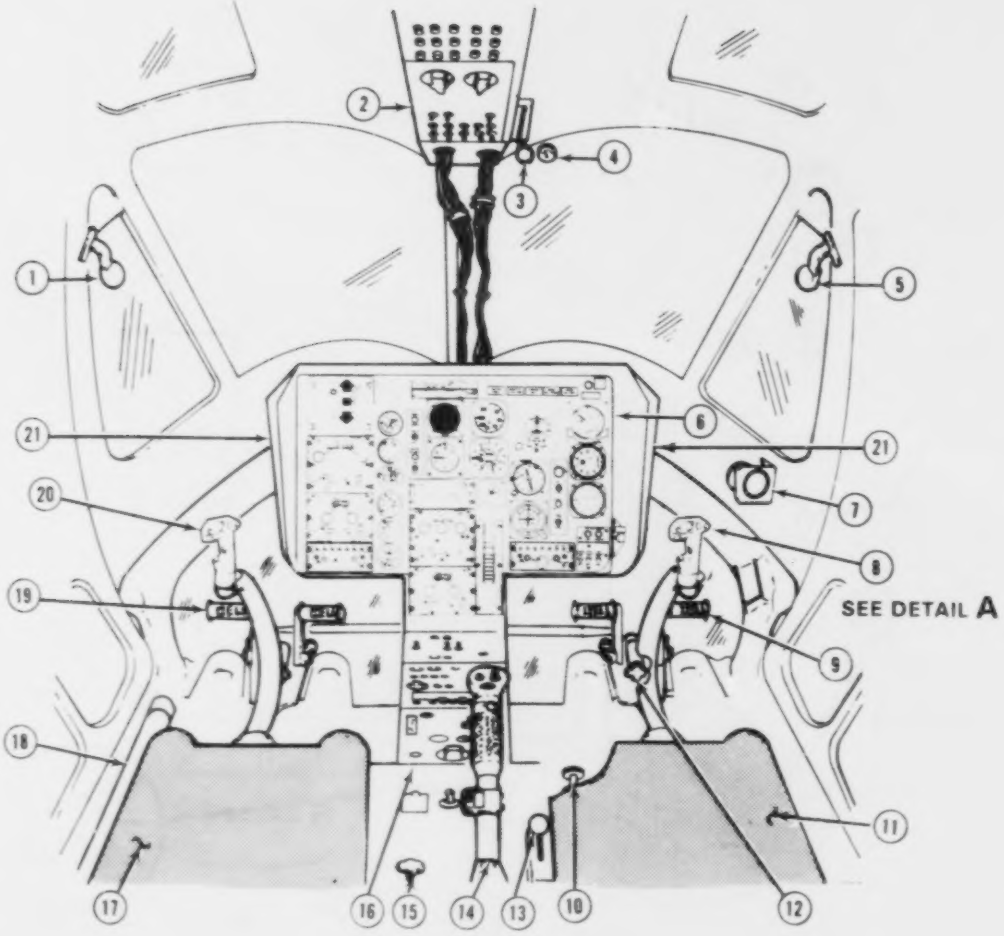
Figure 2-3. Compartment Diagram A (Sheet 2 of 2)



NOTE: Flat glass model shown

SEE DETAIL B

1. Copilot Door Emergency Jettison Handle
2. Overhead Console
3. Fuel ON/OFF Control Handle
4. Free Air Temperature (FAT) Gage
5. Pilot Door Emergency Jettison Handle
6. Instrument Panel
7. Magnetic Compass
8. Pilot Cyclic Stick
9. Pilot Anti-Torque Pedals
10. Cyclic Friction Control Adjustment
11. Pilot Seat
12. Anti-Torque Pedal Adjuster
13. Shoulder Harness Lock
14. Pilot Collective Lever
15. Collective Friction Control Adjustment
16. Console
17. Copilot/Observer Seat
18. Copilot Collective Lever
19. Copilot Anti-Torque Pedals
20. Copilot Cyclic Stick
21. Glare Shield

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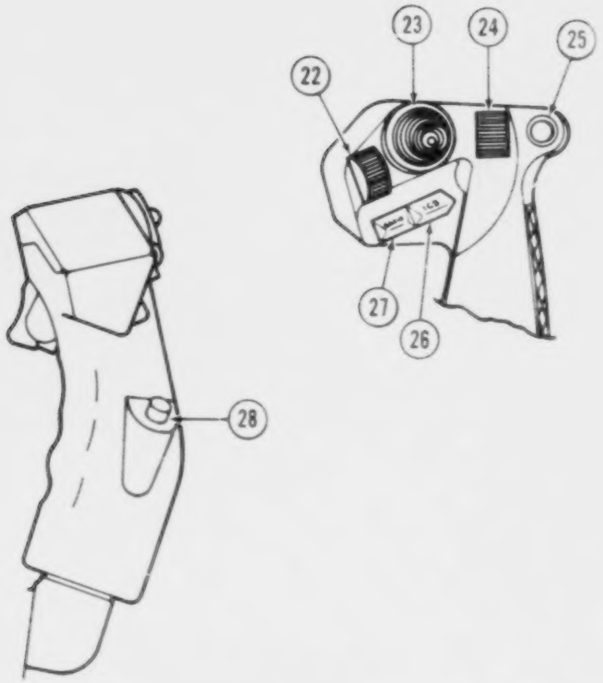
Figure 2-4. Pilot and Copilot/Observer Station Diagram C (Sheet 1 of 3)



DETAIL A

22. Night Vision Goggles Light Switch
23. Not Used
24. Not Used
25. Force Trim Switch
26. ICS Switch
27. Radio Transmit Switch
28. Not Used

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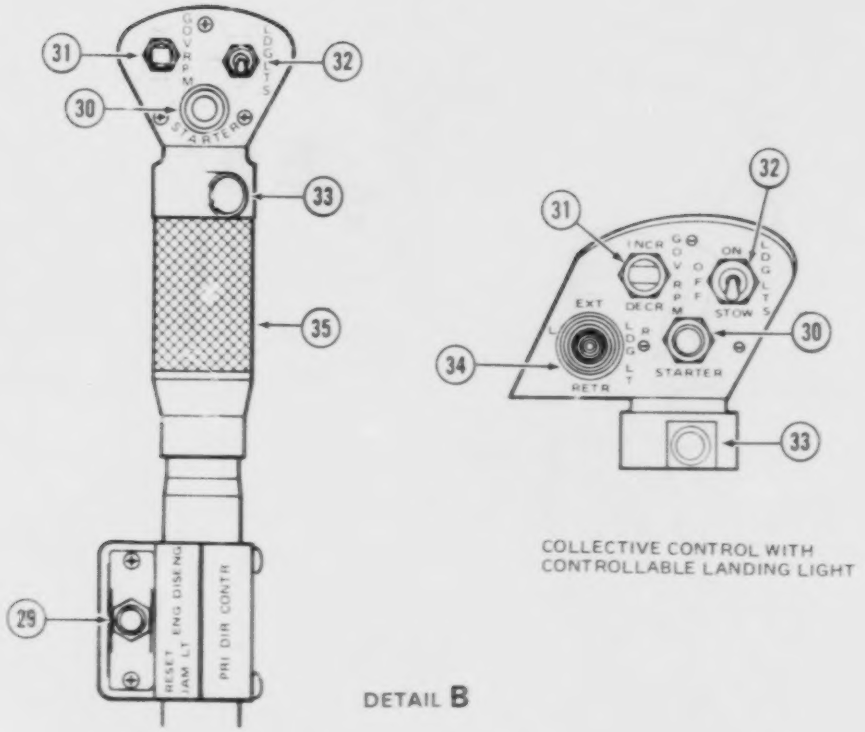
Figure 2-4. Pilot and Copilot/Observer Station Diagram C (Sheet 2 of 3)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GOV RPM
LDG LTS
STARTER
RESET JAM LT
ENG DISENG
PRI DIR CONTR
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INCR
DECR
GOV RPM
OFF
ON
STOW
LDG LTS
EXT
RETR
LDG LT
STARTER
34
30
33

COLLECTIVE CONTROL WITH CONTROLLABLE LANDING LIGHT

DETAIL **B**

29. Primary Directional Control Switch
30. Starter Switch
31. Governor Switch
32. Search/Landing Lights
33. Engine Idle Release Control
34. IR/White (Dual) Landing/Searchlights
35. Throttle

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Figure 2-4. Pilot and Copilot/Observer Station Diagram **C** (Sheet 3 of 3)

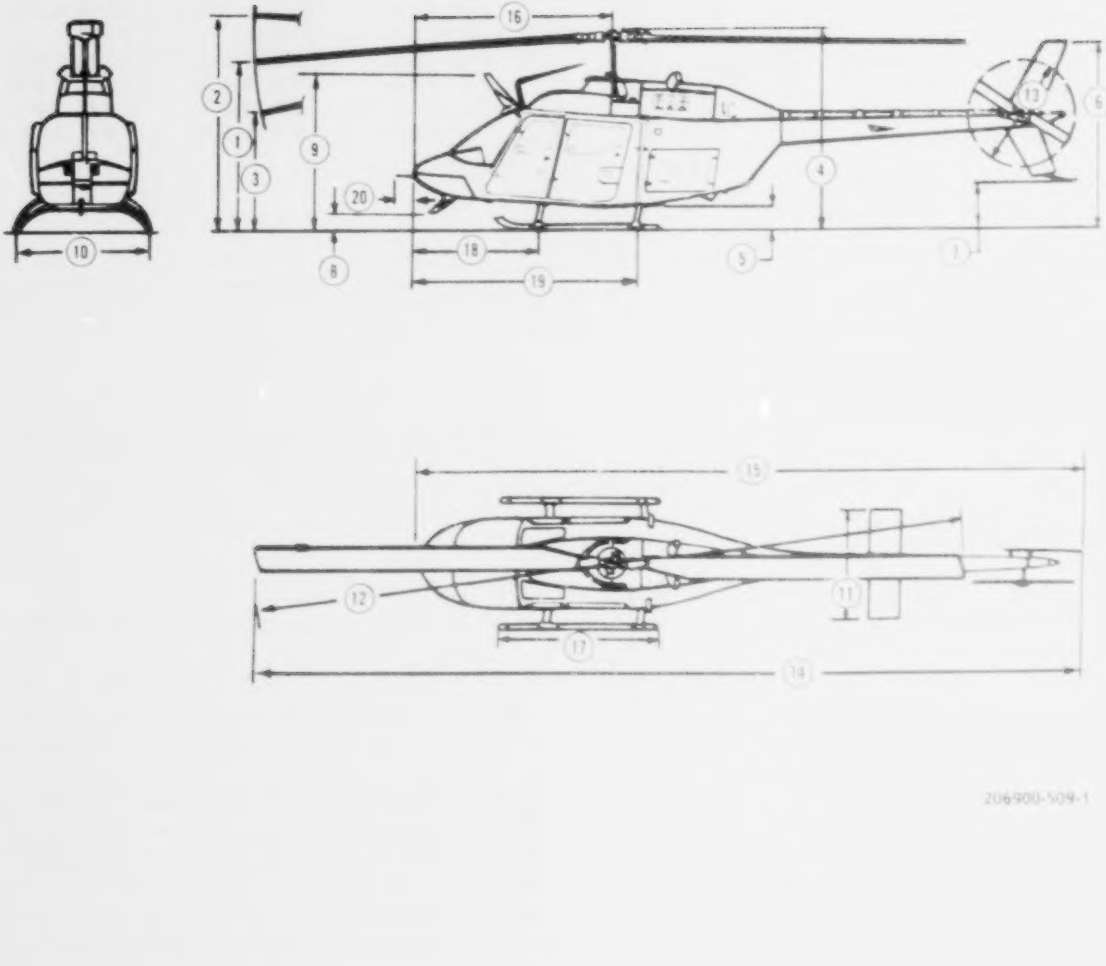
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Figure 2-5. Principal Dimensions (Sheet 1 of 2)

HEIGHT	STANDARD SKID GEAR	HIGH SKID GEAR	FLOAT GEAR A
1. Forward Tip of Main Rotor (Static Position) to Ground with Droop	9 ft. 6.0 in.	10 ft. 0.0 in.	9 ft. 7.9 in.
2. Forward Tip of Main Rotor to Ground (Tie-down)	12 ft. 0.0 in.	12 ft. 6.0 in.	12 ft. 1.9 in.
3. Forward Tip of Main Rotor to Ground (Forward Down)	6 ft. 8.0 in.	7 ft. 2.0 in.	6 ft. 10 in.
4. Ground to Top of Main Rotor Reservoirs	9 ft. 7.0 in.	10 ft. 9.0 in.	10 ft. 5.4 in.
5. Bottom of Cabin	13.0 in.	27.0 in.	28 in.
6. Top of Vertical Stabilizer	8 ft. 1.5 in.	10 ft. 1.5 in.	11 ft. 1.0 in.
7. Tail Skid to Ground	1 ft. 4.4 in.	3 ft. 4.4 in.	4 ft. 4.0 in.
8. Lower Cutter to Ground	12.0 in.	2 ft. 2.0 in.	2 ft. 3.0 in.
9. Upper Cutter to Ground	7 ft. 9.5 in.	9 ft. 9.5 in.	9 ft. 10.5 in.
Width			
10. Skid Gear	6 ft. 5.4 in.	7 ft. 3.0 in.	11 ft. 6.1 in.
11. Horizontal Stabilizer	6 ft. 5.2 in.	No change	No change
DIAMETERS			
12. Main Rotor	35 ft. 4.0 in.	No change	No change
13. Tail Rotor	5 ft. 2.0 in.	No change	No change
LENGTH			
14. Overall (Main Rotor Fore and Aft) to Aft End of Tail Skid	40 ft. 11.8 in.	No change	No change
15. Nose of Cabin to Aft End of Tail Skid	32 ft. 2.0 in.	No change	No change
16. Nose of Cabin to Center Line of Main Rotor	8 ft. 10.1 in.	No change	No change
17. Skid Gear	8 ft. 1.3 in.	10 ft. 4.2 in.	19 ft. 5.0 in.
18. Nose of Cabin to Center Line of Forward Cross Tube	6 ft. 0.0 in.	5 ft. 9.4 in.	5 ft. 11.7 in.
19. Nose of Cabin to Center Line of Aft Cross Tube	10 ft. 9.0 in.	10 ft. 6.3 in.	10 ft. 8.7 in.
20. Pitot Tube	6.8 in.	No change	No change

* Check antennas that may protrude lower.

206900-509-2

Figure 2-5. Principal Dimensions (Sheet 2 of 2)

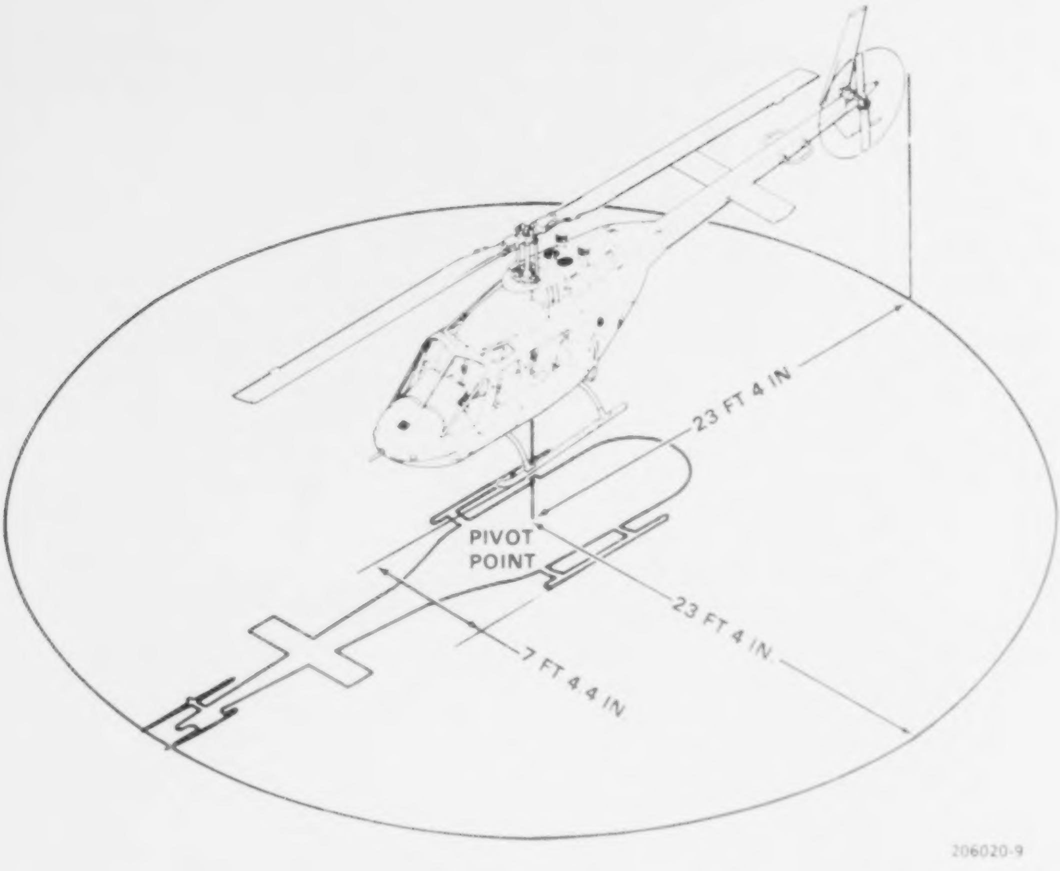


Figure 2-6. Turning Radius and Ground Clearance

inches of ground clearance. This will improve landings to be accomplished in snow and rough terrain areas.

c. **A** **Float Gear**. The float landing gear (figure 2-7) consists of two streamlined multi-cell inflatable floats, float support tubes, crosstubes, and necessary fittings required to equip the helicopter for water landings. A triangular plate is attached to the tail skid for added controllability and protection of the tail rotor in the event of a tail low water landing. Landing may be made on smooth surfaces that do not have protrusions that could damage floats.

d. **Tail Skid**. A tubular steel tail skid is attached to the lower section of the vertical fin and provides protection for the tail rotor in landings by indicating a tail low condition.

2-4. COCKPIT AND CABIN DOORS.

WARNING

Inadvertent jettisoning of cockpit doors is possible if jettison handle is utilized as a handhold, or hand rest during flight.

Four entrance doors are provided for access to the aircraft interior. The doors are of bonded sheet metal construction with acrylic plastic windows. Each door may be jettisoned by means of emergency jettison handle. All four doors are provided with door lock devices. The pilot door has a padlock while the other three doors have loop locking devices (figure 2-8).

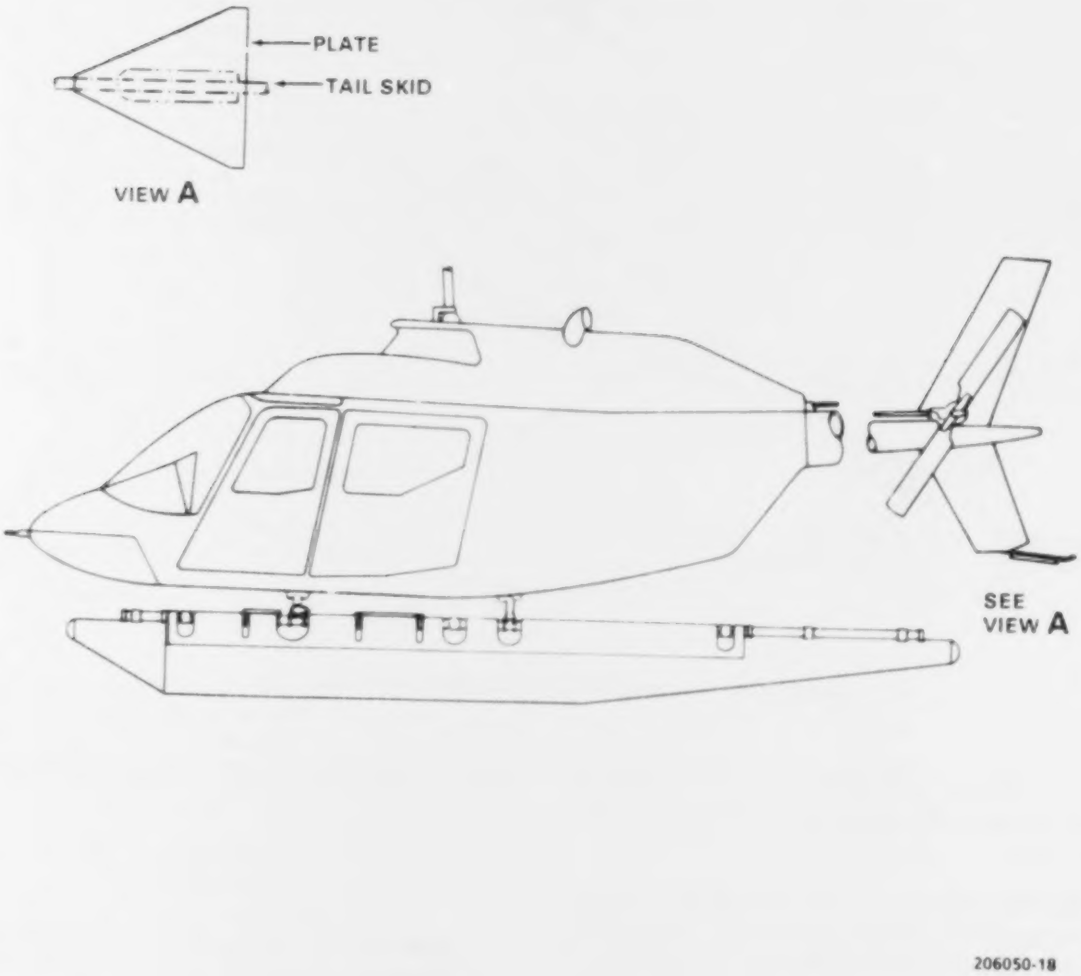
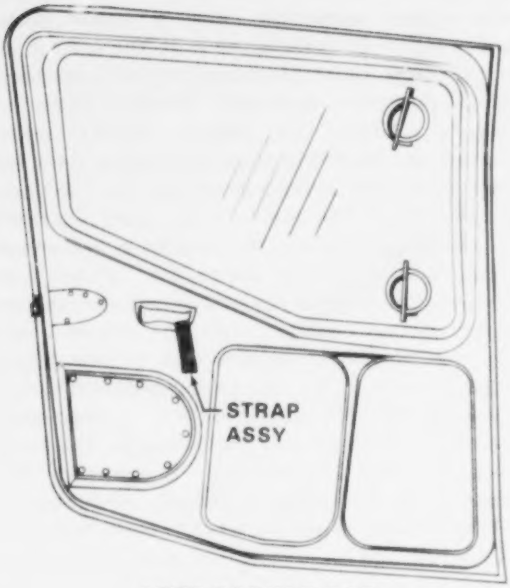
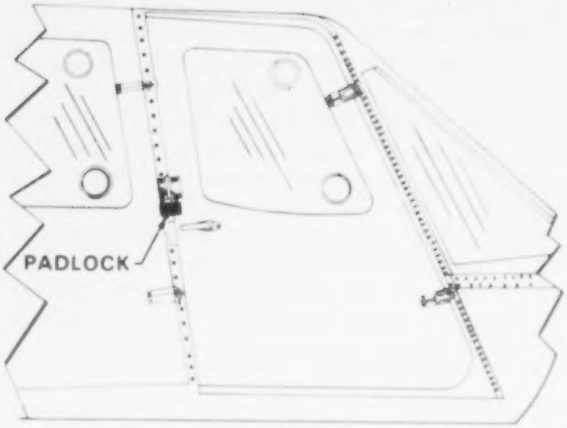


PLATE
TAIL SKID
VIEW A
SEE VIEW A
206050-18

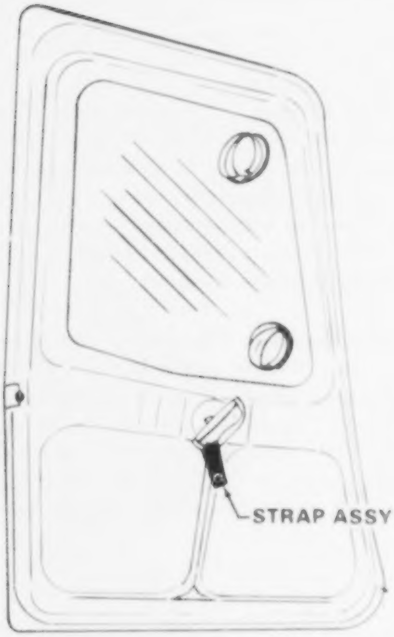
Figure 2-7. Float Gear Equipped Helicopter **A**



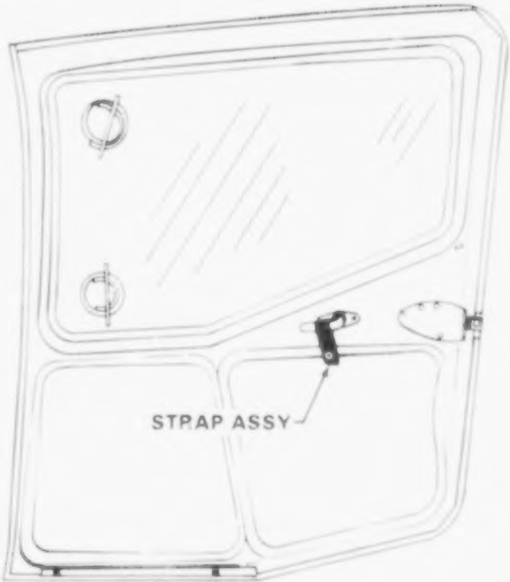
LEFT CABIN DOOR



PILOT DOOR



COPILOT/OBSERVER DOOR


STRAP ASSY

RIGHT CABIN DOOR

206070-292

Figure 2-8. Locking Devices for Doors

2-5. SEATS.

a. **Pilot and Copilot/Observer Seats.** The pilot and copilot/observer seats are constructed of tubing and stretched nylon material. Each seat is equipped with provisions for cushions, safety belts, and shoulder harness. An inertia reel, with a manually operated control handle, is incorporated on each seat. The inertia reel is a mechanical restraining device that is designed to hold pilot in a normal seated position during any maneuver which would tend to pitch the pilot forward. Each reel is connected to a shoulder harness with a web strap. An automatic locking mechanism, a webbing roller, and a manual control are incorporated in each unit (figure 2-3).

b. **Passenger Seats.** The passenger seats are constructed of aluminum honeycomb panels and form an integral part of the airframe. The center panel of the seat back is removable to gain access to fuel cell. Seats are equipped with shoulder harness, safety belts, and cushions. Seating is provided for two passengers or without seats, space is provided for cargo (figure 2-3).

2-6. WIRE STRIKE PROTECTION SYSTEM (WSPS).

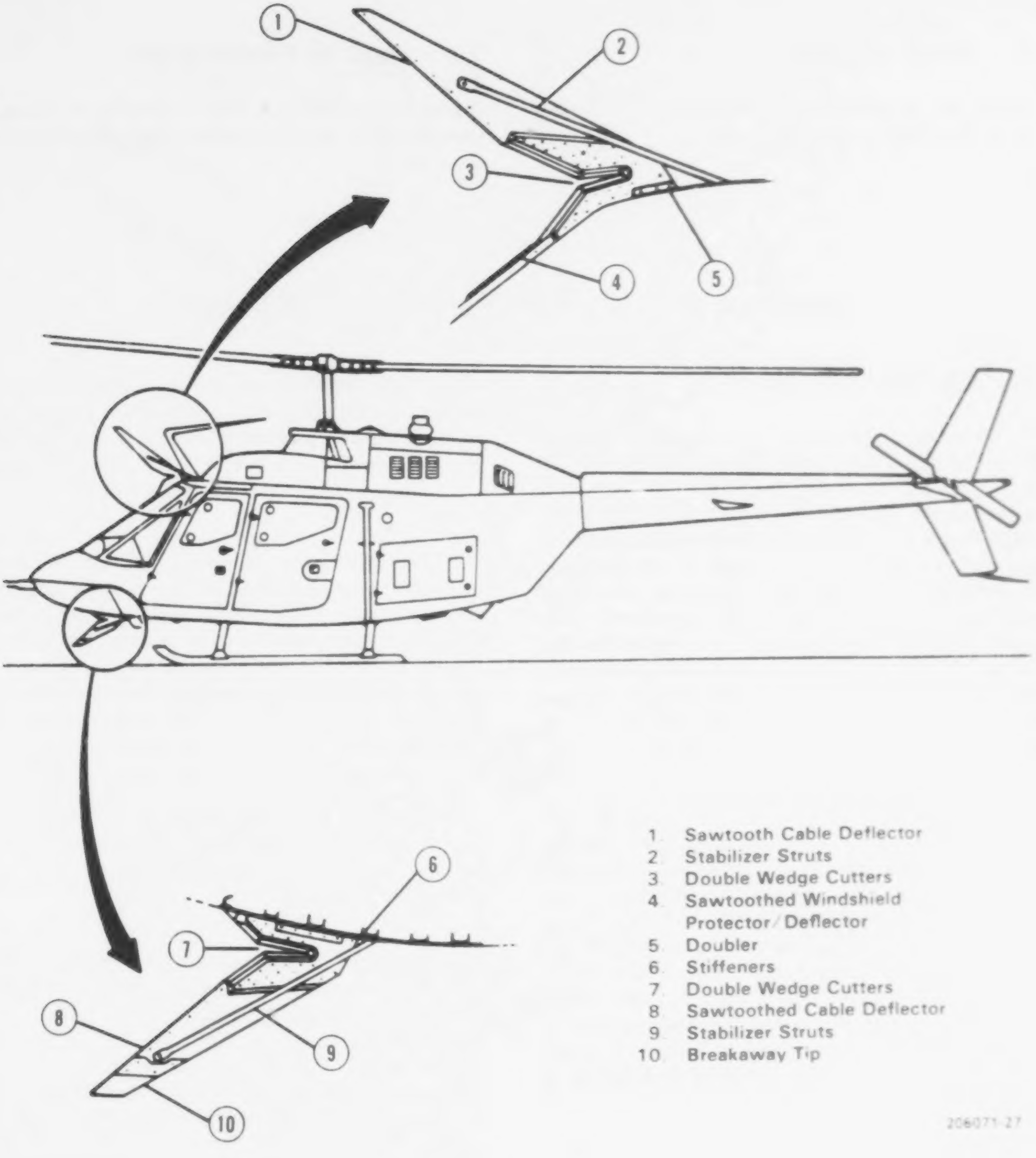
WARNING

Flight with the landing light in other than the fully stowed position on OH-58A/C aircraft may degrade the effectiveness of the Wire Strike Protection System (WSPS). When use of the controllable landing light is not anticipated, it should be in the fully stowed position.

The WSPS provides protection against frontal impacts with horizontally strung mechanical and power transmission wires. The basic system consists of an upper cutter assembly, a windshield deflector/cutter assembly, and a lower cutter assembly (figure 2-1 and figure 2-2). The windshield deflector/cutter assembly, consisting of a sawtooth equipped aluminum extrusion, provides deflection mechanism into the upper cutter while simultaneously abrading thus weakening wire and provides additional structural support for the upper cutter mounting. The mechanical cutter assembly (upper and lower) (figure 2-9) consists of a sawtooth equipped deflector section, providing deflection/abrading feature similar to the windshield deflector section, leading into the primary wire cutting mechanism — wedge type cutting blades positioned to provide the necessary mechanical advantage to cut the design objective wires while minimizing load input into the airframe. The lower cutter assembly features a "Breakaway Tip" designed to shear when relatively large ground contact forces are experienced and before helicopter structural damage is incurred. However, the tip shear rivets are designed to withstand the smaller forces experienced during wire strikes and the tip will still effectively deflect wires into the cutter blades.

a. **Wire Strikes.** If avoidance is not possible or not effective a wire strike will occur. The protection provided by the WSPS is 90% of frontal area. The cable impact/deflection/cutting sequence of the design objective cables does not have a significant effect on aircraft performance, control, crew functioning or blade flapping.

b. **Avoidance.** The most effective defense against wire strikes is avoidance. Because of the many different encounters that can occur, it is not possible to provide a procedure to cover every situation. The success in coping with emergency depends on quick analysis of the condition and selection of the proper evasive maneuvers.



1. Sawtooth Cable Deflector
2. Stabilizer Struts
3. Double Wedge Cutters
4. Sawtoothed Windshield Protector/Deflector
5. Doubler
6. Stiffeners
7. Double Wedge Cutters
8. Sawtoothed Cable Deflector
9. Stabilizer Struts
10. Breakaway Tip

206071-27

Figure 2-9. WSPS Configuration

SECTION II. EMERGENCY EQUIPMENT

2-7. FIRST AID KIT.

An aeronautical type first aid kit is located on the right side of the center support column.

2-8. FIRE EXTINGUISHER.

A portable fire extinguisher is mounted in a bracket located on the right side of the center support column (figure 9-1).

SECTION III. ENGINES AND RELATED SYSTEMS

2-9. ENGINE.

The OH-58A/C helicopter is equipped with a T63-A-700 A, T63-A-720 C gas turbine engine (figure 2-10 A and figure 2-11 C). The engine is designed for a low fuel consumption, light weight, minimum size, maximum reliability and ease of maintenance. The engine is installed aft of the mast and the passenger compartment. The engine cowl aft of the engine air inlet is removable as a single unit or the hinged section the length of the engine on either side may be opened individually. The aft fairing covers the engine oil cooler, provides tail rotor driveshaft access and provides air intake for the engine oil cooler. The major engine components are as follows:

a. **Compressor**. Air enters the engine through the particle separator to the compressor inlet and is compressed by six axial compressor stages and one centrifugal stage. The particle separator removes dirt and other contaminates from the incoming air and ejects the dirt out ducts on either side of the fairing. This allows cleaned air to enter the engine compressor section. The compressed air is discharged through the scroll type diffuser into two external ducts which convey the air to the combustion section.

b. **Combustion Section**. The combustion section consists of the outer combustion case and the combustion liner. A spark ignitor and a fuel nozzle are mounted in the aft end of the outer combustion case. Air enters the single combustion liner at the aft end, through holes in the liner dome and skin. The air is mixed with fuel sprayed from the fuel nozzle and combustion takes place. Combustion gasses move forward out of the combustion liner to the first-stage gas producer turbine nozzle.

c. **Turbine**. The turbine consists of a gas producer turbine support, a power turbine support, a turbine and exhaust collector support, a gas producer turbine rotor and a power turbine rotor. The turbine is mounted between the combustion section and the power and accessory gearbox. The two-stage gas producer turbine drives the compressor and accessory gear train. Gas discharged from the gas producer turbine drives the two-stage power turbine which furnishes the output power of the engine. The gas from the power turbine discharges in an upward direction through twin ducts in the turbine and exhaust collector support.

d. **Power and Accessories Gearbox**. The main power and accessory drive gear train are enclosed in a single gear case. The gear case serves as a structural support of the engine. All engine components including the engine mounted accessories are attached to the case. A two-stage helical and spur gear set is used to reduce rotational speed from the power turbine to the output drive spline. Accessories driven by the power turbine gear train are the power turbine tachometer-generator and the power turbine governor. The gas producer drives the compressor and through an accessory gear train drives the fuel pump, gas producer tach generator, gas producer fuel control, starter-generator, and engine oil pump.

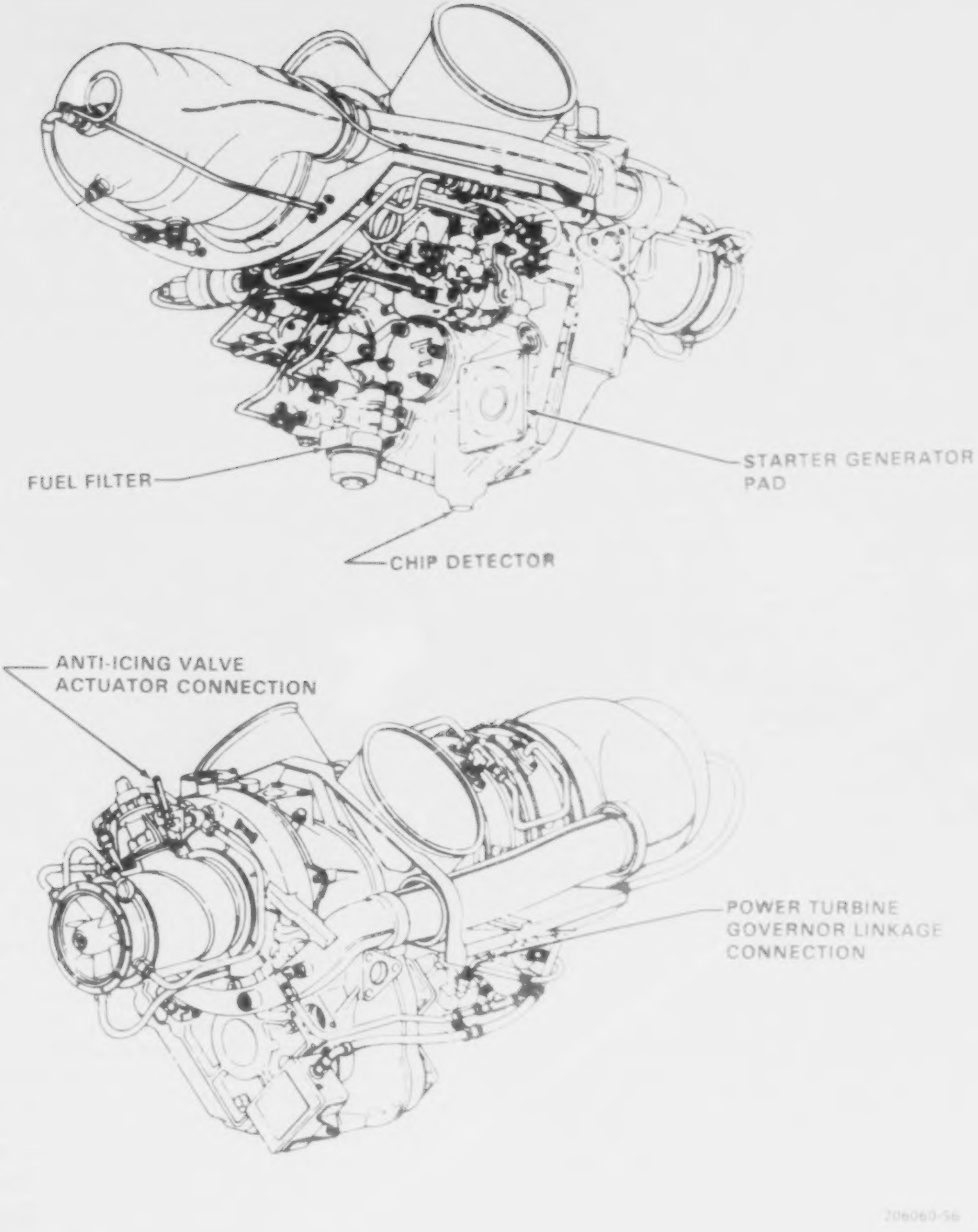
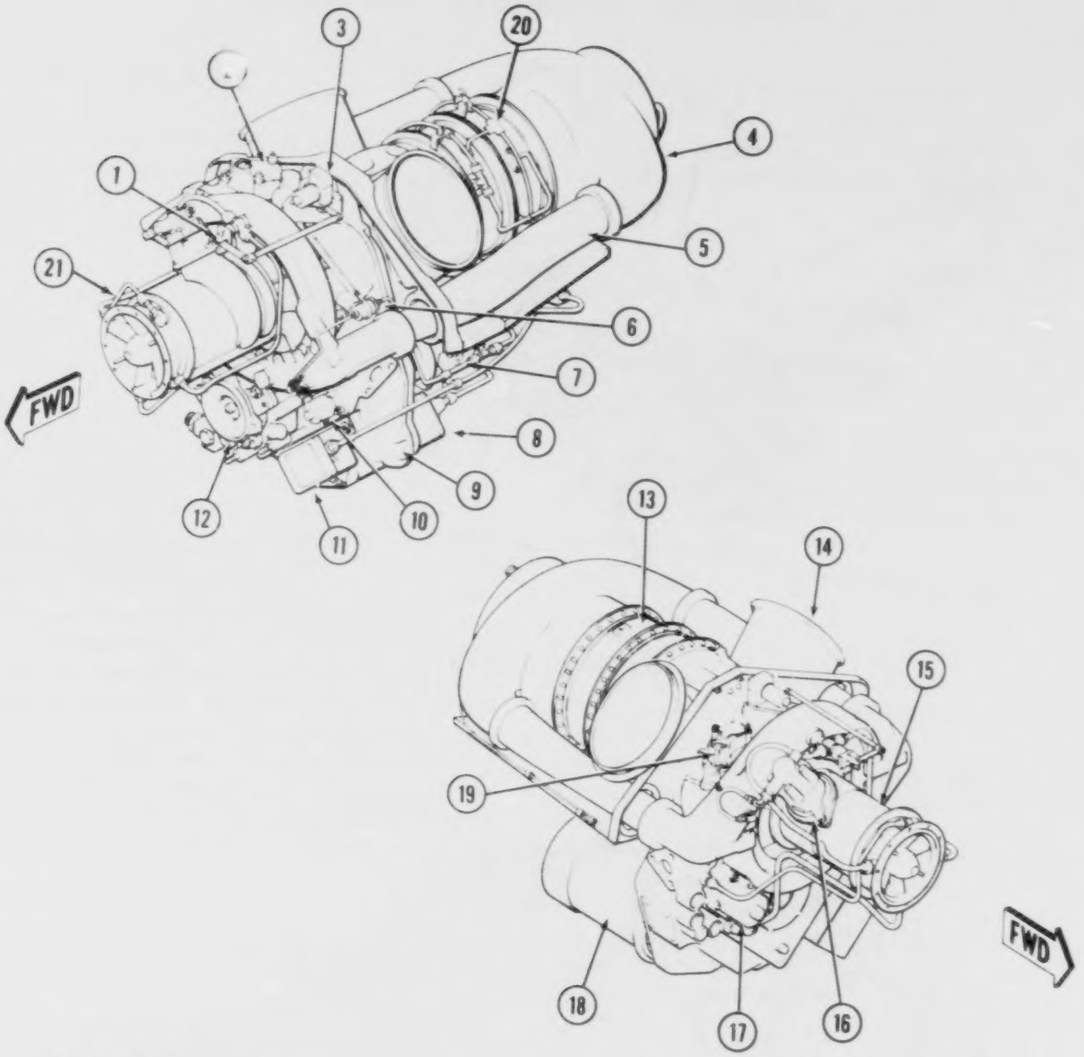

FUEL FILTER
STARTER GENERATOR PAD
CHIP DETECTOR
ANTI-ICING VALVE ACTUATOR CONNECTION
POWER TURBINE GOVERNOR LINKAGE CONNECTION
206060-56

Figure 2-10. Engine A



1. Anti-Ice Valve
2. Oil Filter
3. Anti-Ice Control Actuator
4. Combustion Section
5. Compressor Discharge Tubes
6. Air Filter
7. Power Turbine Governor
8. Fuel Pump and Filter
9. Accessory Gearbox
10. Tachometer Generator (Power Turbine)
11. Ignition Exciter Assembly
12. Freewheeling Unit
13. Turbine Section
14. Exhaust Stack
15. Compressor Section
16. Compressor Bleed Valve Assembly
17. Tachometer Generator (Gas Producer)
18. Starter Generator
19. Oil Pressure Regulator
20. TOT Harness
21. Engine Oil Lines

206001-183

Figure 2-11. Engine C

2-10. ENGINE COMPARTMENT COOLING.

Openings are provided on both sides of the engine and top C cowling for compartment cooling. The center cowl section houses the engine air inlet, the inlet bellmouth and the forward firewall. Suspended below the engine is a stainless fire shield. Below the fire shield is a titanium floor which acts as a drip pan and also gives insulation from heat.

2-11. INDUCTION SYSTEM.

The engine air inlet system consists of an induction fairing with inlets on each outboard side. This fairing provides mounting for the particle separator. The particle separator removes dirt and other contaminates from the incoming air and ejects the dirt out eductor tubes on either side of the fairing. This allows cleaned air to enter the engine compressor section. Removable reverse flow inlet fairings may be installed over the air inlets on modified induction fairings. These reverse flow fairings minimize ram effect of falling or blowing snow, thus permitting effective operation of the particle separator and preventing engine flame-out caused by ingestion of snow.

a. **Intake Ducting.** The engine air intake ducting consists of louvered openings and a large circular air inlet opening. The louvered openings are located on left and right cowl panels.

b. **Particle Separator.** Foreign matter is removed from the engine inlet air by a centrifugal-type particle separator. The particle separator consists of a group of separator tube assemblies arranged in rows and positioned in a front and rear sheetmetal panel and a scavenge system. The separator tube assemblies consist of an inlet tube, a swirl tube which is bonded inside the inlet tube, and an outlet tube. The scavenge system consists of a bleed air manifold, bleed air nozzles, and ejector tubes which are contained in two ejector boxes located beneath the separator tube assemblies. The bleed air manifold is attached to the ejector boxes and is connected directly to the engine compressor scroll with bleed air inlet fittings. Air enters the inlet tube and is spun by the swirl tube. Clean air then enters the engine inlet plenum chamber through the outlet tube while foreign material is centrifuged into the scavenge system. The foreign material is ejected overboard by the vacuum-cleaner effect created by engine bleed air as it is discharged through venturies in the eductor tubes. Reverse flow inlet fairings may be attached to the engine air inlets. These sheet metal fairings make it impossible for air to enter the plenum chamber without first making two 180° turns. These abrupt changes in airflow greatly reduce the probability of engine flame-out associated with snow ingestion.

2-12. ENGINE INLET ANTI-ICING SYSTEM.

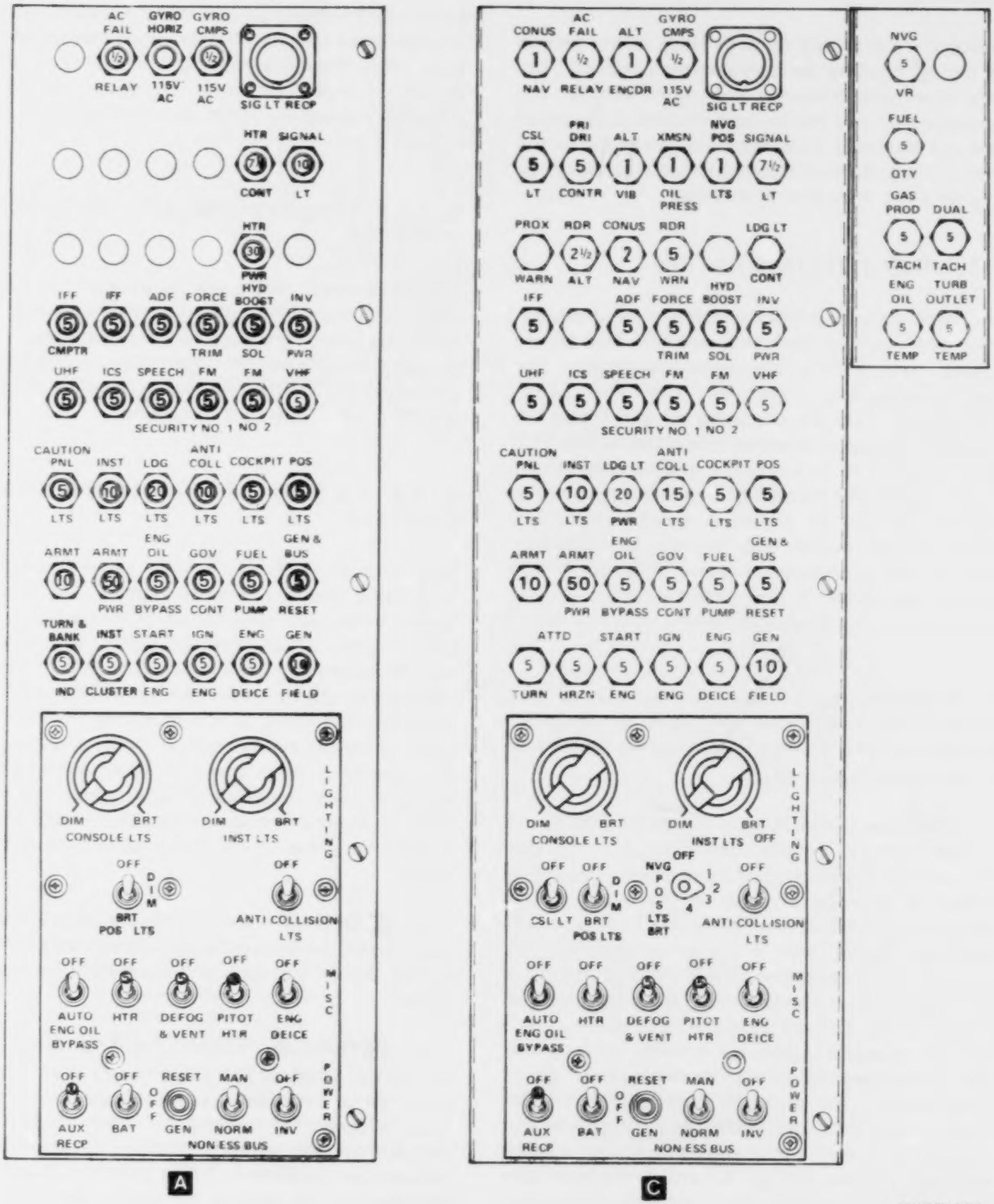
The compressor inlet guide vanes and front bearing support hub are the only engine components with anti-icing provisions. Anti-icing is provided by the use of compressor bleed air. Anti-icing is actuated by placing ENG DEICE switch on overhead console (figure 2-12) to ENG DEICE position.

2-13. ENGINE FUEL CONTROL SYSTEM.

The system controls engine power output by controlling the gas producer speed. Gas producer speed levels are established by the action of the power turbine fuel governor which senses power turbine speed. The power turbine (load) speed is selected by the operator and the power required to maintain this speed is automatically maintained by power turbine governor action on metered fuel flow. The power turbine governor lever schedules the power turbine governor requirements. The power turbine governor schedules the gas producer speed to a changed power output to maintain output shaft speed.

a. **A Throttle.** The throttle (figure 2-3) is a twist grip type on the collective stick. The throttle is rotated to the left to increase or to the right to decrease power.

b. **C Throttle.** Rotating the throttle (figure 2-4) to the full open position allows the power turbine governor to maintain a constant rpm. Rotating the throttle toward the closed position will cause the rpm to be manually selected instead of automatically selected by the power turbine governor. Rotating the throttle past the engine-idle stop to the fully closed position shuts off fuel flow. A manually operated idle stop is incorporated to prevent inadvertent throttle closure. The idle stop is controlled by the engine idle release control (figure 2-4).


AC FAIL
½
RELAY
GYRO HORIZ
115V AC
GYRO CMPS
½
115V AC
SIG LT RECP
HTR
7½
CONT
SIGNAL
10
LT
HTR
30
PWR
IFF
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CMPTR
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ADF
5
FORCE
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TRIM
HYD BOOST
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SOL
INV
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PWR
UHF
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ICS
5
SPEECH
5
FM
5
FM
5
VHF
5
SECURITY NO 1 NO 2
CAUTION PNL
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INST
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LTS
LDG
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ANTI COLL
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COCKPIT
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POS
5
LTS
ARMT
10
ARMT
50
PWR
ENG OIL
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BYPASS
GOV
5
CONT
FUEL
5
PUMP
GEN & BUS
5
RESET
TURN & BANK
5
IND
INST
5
CLUSTER
START
5
ENG
IGN
5
ENG
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DEICE
GEN
10
FIELD
DIM
BRT
CONSOLE LTS
DIM
BRT
INST LTS
LIGHTING
OFF
DIM
BRT
POS LTS
OFF
ANTI COLLISION LTS
OFF
AUTO ENG OIL BYPASS
OFF
HTR
OFF
DEFOG & VENT
OFF
PITOT HTR
OFF
ENG DEICE
MISC
OFF
AUX RECP
OFF
BAT
OFF
RESET
GEN
MAN
NORM
OFF
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A
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GYRO CMPS
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115V AC
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ANTI COLLISION LTS
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NON ESS BUS
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5
QTY
GAS PROD
5
TACH
DUAL
5
TACH
ENG OIL
5
TEMP
TURB OUTLET
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TEMP
C
206075-251

Figure 2-12. Overhead Console

c. **Droop Compensator.** A droop compensator maintains engine rpm (N2) as power demand is increased. The compensator is a direct mechanical linkage between the collective stick and the speed selector lever on the N2 governor. Droop is defined as the speed change in N2 rpm as power is increased from a no-load condition. Without droop compensation, instability would develop as engine output is increased, resulting in N1 speed overshooting or hunting the value necessary to satisfy the new power condition. If N2 power is allowed to droop, other than momentarily, the reduction in rotor speed could become critical.

d. **Engine Idle Release Control.** The engine idle release is a spring loaded plunger mounted on the switch box of the pilot collective stick (figure 2-3 and figure 2-4). The plunger prevents the pilot from accidentally retarding the throttle beyond engine idle position. This acts as a safety feature by preventing inadvertent engine shutdown. The plunger need not be depressed when performing an engine start or runup; however, the plunger must be depressed when accomplishing an engine shutdown or when it is desired to retard the power control below the engine idle position.

e. **Governor RPM Switch.** The GOV INCR/DECR switch is mounted on the pilot collective stick (figure 2-3 and 2-4). The switch is a three-position momentary type and is held in the INCR position (FWD) to increase the power turbine (N2) speed or DECR position (AFT) to decrease the power turbine (N2) speed. Regulated power turbine speed may be adjusted in flight through the operating range by movement of the switch as required.

f. **A Gas Producer Fuel Control.** The gas producer fuel control has a bypass valve, metering valve, acceleration bellows, governing and enrichment bellows, manually operated cutoff valve, maximum pressure relief valve, and a torque tube seal and lever assembly. A maximum pressure relief valve is incorporated to protect the system from excessive fuel pressure. The fuel control incorporates a bleed air heating system, consisting of fittings, a manually actuated valve, and a heating element at the fuel control to prevent formation of ice in the pneumatic system.

g. **Power Turbine Governor.** The power turbine speed is scheduled by the power turbine governor lever and the power turbine speed scheduling cam. The cam sets a governor spring load which opposes a speed-weight output. Overspeed protection of the power turbine governor becomes effective at approximately 108% N2. This governing action will result in a pulsating increase/decrease of engine power.

h. **A Fuel Pump and Filter Assembly.** The fuel pump and filter assembly incorporates two gear-type pumping elements arranged in tandem and driven by a common driveshaft. Fuel enters the engine fuel system at the inlet port of the pump and passes through a low pressure filter before entering the gear elements. The gear elements are arranged in parallel and each pumping element has sufficient capacity to permit take-off power operation in the event of failure of the other pump element. Two discharge check valves are provided in the assembly to prevent reverse flow in event of failure of one gear pumping element. A bypass valve in the pump assembly allows fuel to bypass the filter element if it becomes clogged. The bypass return flow from the fuel control is passed back to the inlet of the gear elements through a pressure regulating valve which maintains the bypass flow pressure above inlet pressure. By means of passages leading to auxiliary filling ports on the periphery of the gear elements, a portion of the bypass flow is used to fill the gear teeth when vapor-liquid conditions exist at the inlet to the gear elements. Paper filter is located inside the fuel pump assembly upstream of the gear elements. It is retained by a threaded cover (distinguished by a hex) which can be found on the lower side of the pump.

i. **C Fuel Pump and Filter Assembly.** The fuel pump and filter assembly incorporates a single gear-type pumping element, a low pressure barrier filter, a filter bypass valve, and a bypass pressure regulating valve. Fuel enters the engine fuel system at the inlet port of the pump and passes through the low pressure filter before entering the gear element. The filter bypass valve allows fuel to bypass the filter element if it becomes clogged. The bypass return flow from the fuel control is passed back to the inlet of the gear element through a pressure regulating valve which maintains the bypass flow pressure above inlet pressure.

j. **A Fuel Nozzle.** The fuel nozzle is a single-entry dual-orifice type unit which contains an integral valve for dividing primary and secondary flow. This same valve acts as a fuel shutoff valve when the fuel manifold pressure falls below a predetermined pressure, thus keeping fuel out of the combustion chamber at shutdown.

k. **C** **Fuel Nozzle.** The fuel nozzle is a single-entry dual-orifice type unit which contains an integral valve for dividing primary and secondary flow.

l. **A** **Fuel Control Heater.** The fuel control heater improves engine reliability by preventing auto acceleration during engine start operations after cold soak. The fuel control heater valve is located on right side of engine. With handle in vertical position, the valve is open. With handle in horizontal position, the valve is closed.

2-14. C INFRARED SUPPRESSION SYSTEM.

The infrared suppression system is specially formulated to reduce detection of IR-seeking missiles. The system consists of two exhaust stacks located at the top of the engine cowling and two shields located on the side engine cowling (figure 2-2). The exhaust stacks have cooling fins and a shield around them to reduce the infrared signature of the hot engine exhaust. The shields on the side engine cowling prevent detection of the hot engine area from the sides.

2-15. TEMPERATURE MEASUREMENT SYSTEM.

The temperature measurement system consists of four chromel-alumel single junction thermocouples in the gas producer turbine outlet and an associated integral harness. The voltages of the four thermocouples are electrically averaged in the assembly and delivered by the assembly lead to the airframe terminal block for reference to the engine temperature indicating system.

2-16. COMPRESSOR BLEED AIR SYSTEM.

The 5th stage compressor bleed valve permits rapid engine response. The system consists of a compressor discharge pressure sensing port on the scroll, tubing from the sensing port to the bleed valve, a compressor bleed control valve, and a bleed air manifold on the compressor case. Elongated slots between every other vane in the compressor 5th stage bleeds compressor air into a manifold which is an integral part of the compressor case. The manifold forms the mounting flange for the compressor bleed control valve when the compressor case halves are assembled. Compressor discharge air pressure sensing for bleed control valve operation is obtained at a sensing port of the compressor scroll. The bleed control valve is normally open. It is closed by compressor discharge pressure.

2-17. ENGINE OIL SUPPLY SYSTEM.

The lubricating system is a dry sump type with an external reservoir and heat exchanger. A gear type pressure and scavenge pump assembly is mounted within the power and accessory gearbox. The oil filter, filter bypass valve, and pressure regulating valve are in a unit which is located in the upper right side of the power and accessory gearbox housing and are accessible from the top of the engine. The oil tank is mounted aft of the engine rear firewall on top of the intermediate cabin section. A check valve is located between the housing and the filter unit. Probe type magnetic clip detectors are installed at the bottom of the power accessory gearbox and the engine oil outlet connection. All engine oil system lines and connections are internal with the exception of pressure and scavenge lines to the front compressor support, the gas producer turbine support, and the power turbine support. The oil cooler blower is an integral part of the tail rotor drive and is located aft of the freewheeling unit and adjacent to the oil tank.

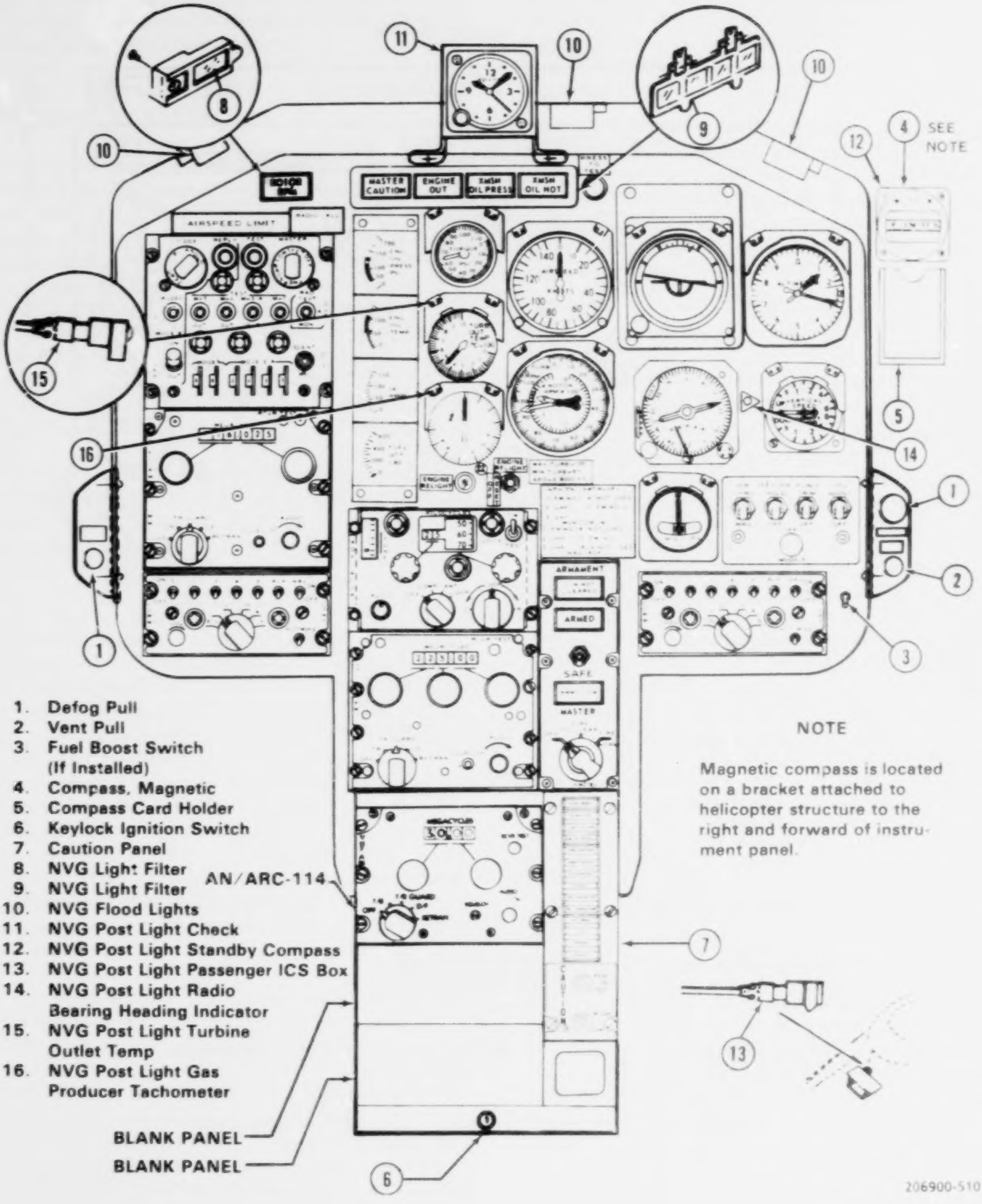
2-18. IGNITION SYSTEM.

a. The engine ignition system consists of a keylock ignition switch, a low tension capacitor discharge ignition exciter, a spark igniter lead, and a shunted surface gap spark igniter. The system derives its input power from the helicopter 28-volt DC electrical system.

b. The keylock ignition switch (figure 2-13 and figure 2-14) locks out the starter system and prevents unauthorized use of the helicopter, thereby preventing possible injury to personnel and/or damage to the equipment.

2-19. STARTER SWITCH.

The starter switch (figure 2-3 and figure 2-4), located in the collective stick switchbox, is a pushbutton type switch. When the switch is pressed, the circuit to the starter relay actuating coil, the igniter unit, and the fuel boost pump are energized. The switch is released when the engine starts cycle is completed or abort start procedures is completed. The keylock ignition


11
10
8
9
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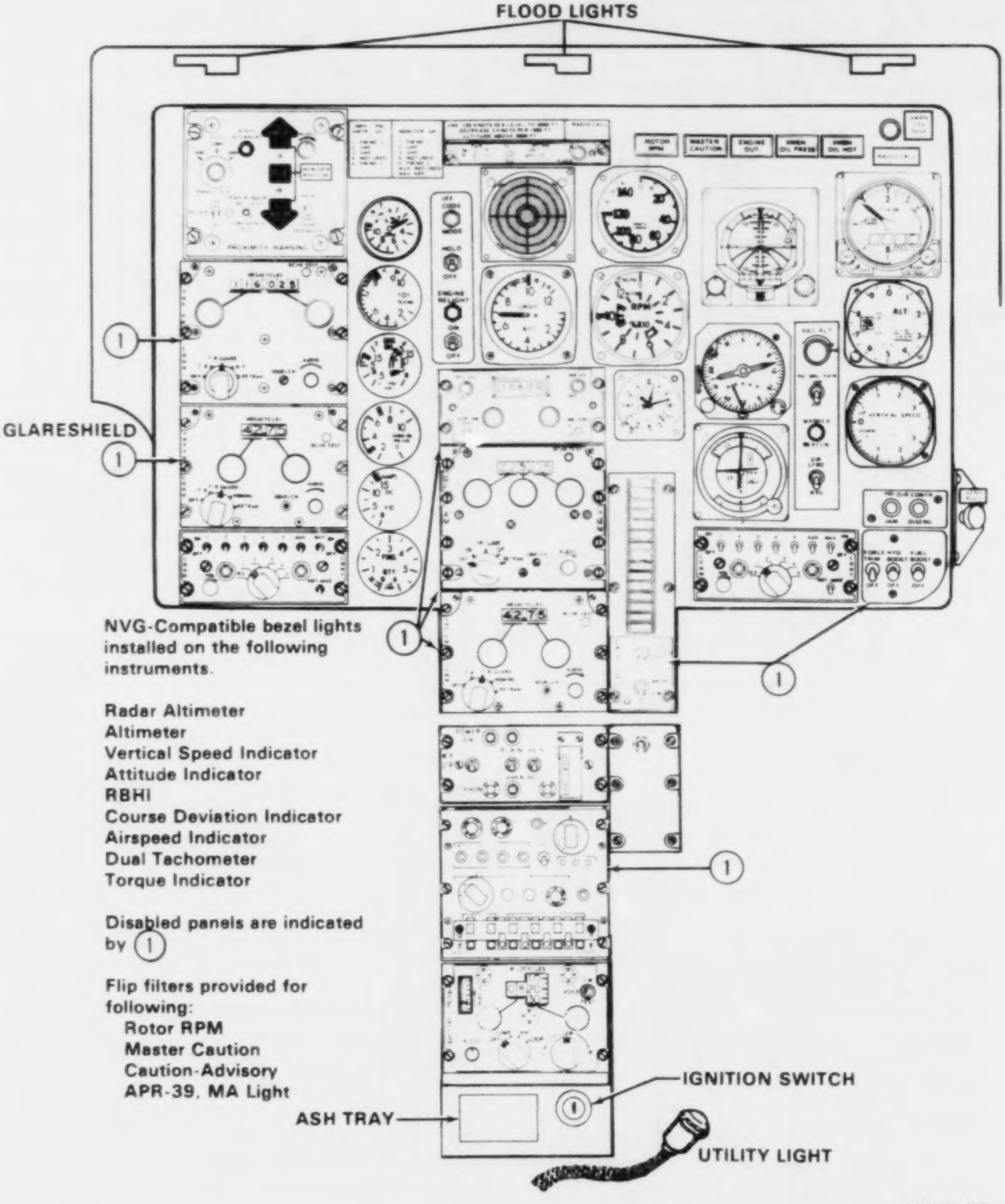
12
4
SEE NOTE
10
MASTER CAUTION
ENGINE OUT
XMSN OIL PRESS
XMSN OIL HOT
ROTOR RPM
AIRSPEED LIMIT
15
16
5
14
1
2
3
1
ENGINE RELIGHT
ARMAMENT
ARMED
SAFE
MASTER
AN/ARC-114
7
CAUTION
13
BLANK PANEL
BLANK PANEL
6
206900-510

1. Defog Pull
2. Vent Pull
3. Fuel Boost Switch (If Installed)
4. Compass, Magnetic
5. Compass Card Holder
6. Keylock Ignition Switch
7. Caution Panel
8. NVG Light Filter
9. NVG Light Filter
10. NVG Flood Lights
11. NVG Post Light Check
12. NVG Post Light Standby Compass
13. NVG Post Light Passenger ICS Box
14. NVG Post Light Radio Bearing Heading Indicator
15. NVG Post Light Turbine Outlet Temp
16. NVG Post Light Gas Producer Tachometer

NOTE

Magnetic compass is located on a bracket attached to helicopter structure to the right and forward of instrument panel.

Figure 2-13. Instrument Panel and Console (Typical) **A**


FLOOD LIGHTS
GLARESHIELD
1
1
1
1
1
PROXIMITY WARNING
ROTOR RPM
MASTER CAUTION
ENGINE OUT
TRANS OIL PRESS
TRANS OIL HOT
42.75
42.75
ALT
VERTICAL SPEED
IGNITION SWITCH
ASH TRAY
UTILITY LIGHT

NVG-Compatible bezel lights installed on the following instruments.

Radar Altimeter
Altimeter
Vertical Speed Indicator
Attitude Indicator
RBHI
Course Deviation Indicator
Airspeed Indicator
Dual Tachometer
Torque Indicator

Disabled panels are indicated by ①

Flip filters provided for following:
  Rotor RPM
  Master Caution
  Caution-Advisory
  APR-39, MA Light

206070-293

Figure 2-14. Instrument Panel and Console C

switch must be ON to complete the ignition circuit. The circuit is protected by the START ENG, IGN ENG, and FUEL PUMP circuit breakers.

2-20. C ENGINE AUTOMATIC RELIGHT SYSTEM.

The engine automatic relight system will provide engine re-ignition capability in the event of an engine flameout. The ENGINE RELIGHT ON/OFF switch (figure 2-14) is spring loaded to the ON position and will actuate the system when bleed air has decayed as a result of a flameout or engine shutdown. The ENGINE RELIGHT light (figure 2-14) will illuminate when the system is actuated. The system will recycle only if the engine ignites after a flameout.

2-21. ENGINE INSTRUMENTS AND INDICATORS.

The engine instruments and indicators are mounted in the instrument panel or the caution panel in the lower console. They are described in the following paragraphs and shown in figure 2-13 and figure 2-14.

a. **Engine Out Warning.** An RPM sensor is connected to the gas producer tachometer. Power is supplied from the CAUTION PNL LTS circuit breaker and connections are made to the ENGINE OUT warning light (figure 2-13 and figure 2-14), and to a tone generator which produces a tone in the pilot headset. The warning system is activated when N1 is below 55 ± 3% and is deactivated above that N1 speed. The audio signal is the same as the low rotor audio signal.

b. **Engine Out Audio Warning.** A switch connected to the collective lever disables the engine out audio warning when the collective lever is in the full down position.

c. **Torquemeter.** The torquemeter (figure 2-13 and figure 2-14), located in the instrument panel, displays pounds of torque A, percent of torque C, produced by the engine. The torquemeter is a direct reading, wetline indicator.

d. **A Turbine Outlet Temperature Gage.** A thermocouple harness assembly with four integral probes is used to sense the temperature of the gases on the outlet side of the gas producer turbine rotor. A DC voltage, which is directly proportional to the gas temperature it senses, is generated by each thermocouple. The thermocouple and thermocouple harness provide an average of the four voltages representative of the turbine outlet temperature (TOT) and this is the temperature indication on the TOT gage on the instrument panel.

e. **C Turbine Outlet Temperature Indicator.** The turbine outlet temperature (TOT) indicator (figure 2-14), located in the instrument panel, displays temperature in degrees celsius of the exhaust gases in the N1 turbine outlet area. The indicator is powered by 28 Vdc and protected by TURB OUTLET TEMP circuit breaker.

f. **Gas Producer Tachometer.** The gas producer tachometer generator, located on the engine, generates an AC voltage with a frequency that is a function of gas producer turbine rotor N1 RPM. The output of the tachometer generator is delivered to the gas producer tachometer indicator which indicates the frequency in terms of percent RPM of gas producer turbine speed. The power for the gas producer tachometer is engine generated and does not depend on the helicopter electrical system.

g. **Dual Tachometer.** The dual tachometer (figure 2-13 A, figure 2-14 C), located in the instrument panel displays the percent RPM of the power turbine and RPM of the main rotor A, both percent RPM C. The outer scale is marked TURB A, ENGINE C and the inner scale is marked ROTOR. The TURB A, ENGINE C, and ROTOR needles are synchronized at normal operating rpm. Operating power for the engine portion of the dual tachometer is derived from the turbine tachometer generator. Operating power for the rotor portion of the dual tachometer is derived from the rotor tachometer. The circuit is powered by 28 Vdc and protected by the DUAL TACH circuit breaker.

h. **A Oil Pressure Gage.** The oil pressure indicator, located on the instrument panel, is a direct-reading, wet-line system. Pressure from the pressure side of the oil pump is indicated in psi. Refer to figure 2-13.

i. **A Oil Temperature Gage.** The engine oil temperature gage, located on the instrument panel, is connected to an electrical resistance type thermocouple and indicates the temperature of the oil at the oil tank outlet.

j. **C Oil Pressure/Temperature Indicator.** The engine oil pressure/temperature indicator (figure 2-14), located in the instrument panel, displays engine oil pressure in psi and temperature in degrees Celsius.

The temperature circuit is powered by 28 Vdc and protected by ENG OIL TEMP circuit breaker. The oil pressure portion of the indicator is a direct reading wetline system.

WARNING

Illumination of the engine oil bypass light may indicate a severe leak is present or developing which could result in total loss of engine oil in a short period of time.

k. **Engine Oil Bypass Caution Light.** The ENG OIL BYPASS caution light (figure 2-13 and figure 2-14), located on the caution panel, will illuminate when the oil tank level is approximately 3 pints low. With the ENG OIL switch **A**, ENG OIL BYPASS switch **C** (figure 2-12) in the AUTO position the engine oil will bypass the oil cooler. A significant rise in engine oil temperature will occur and engine failure can occur in a few minutes due to excessive engine oil temperature and/or engine oil loss. The switch in AUTO position is designed for combat operations only (due to the potential for damage to the oil cooler by hostile fire) to provide the pilot a little additional time to fly out of the immediate enemy danger area only. The switch should be in the OFF position for operation in noncombat environment. The circuit is powered by 28 Vdc and is protected by the CAUTION PNL LTS circuit breaker.

l. **Engine Chip Detector.** There are two electrical engine chip detectors located in the accessory gear case, one at the lowest part and one on the forward right side by the oil pump. The ENG CHIP DET caution light (figure 2-14), located on the caution panel will illuminate when sufficient metal chips to complete the electrical circuit are collected from the engine oil. The system is powered by 28 Vdc and protected by CAUTION PNL LTS circuit breaker.

SECTION IV. FUEL SYSTEM

2-22. FUEL SUPPLY SYSTEM.

The OH-58A/C helicopter is equipped with a self-sealing Crashworthy Fuel System. This system is designed to retain fuel in a crash and provide improved ballistic protection, and is located below and aft of the passenger seat. In addition, the fuel lines are self-sealing. Mounted in the bottom of the cell is one boost pump, one fuel quantity transmitter, one low fuel transmitter, and one fuel sump drain. Installed in top of the cell is one fuel quantity transmitter, a vent line, and a boost pump pressure switch. A fuel filler cap is located on the right side just aft of the passenger door. The fuel shut off valve is mounted on the right side of the aircraft above the fuel cell cavity and is manually operated by the fuel valve handle on the overhead console. A connector for an auxiliary fuel cell is located on the forward side of the fuel cell beneath the seat. Helicopters with crashworthy fuel systems also incorporate the closed circuit refueling provision.

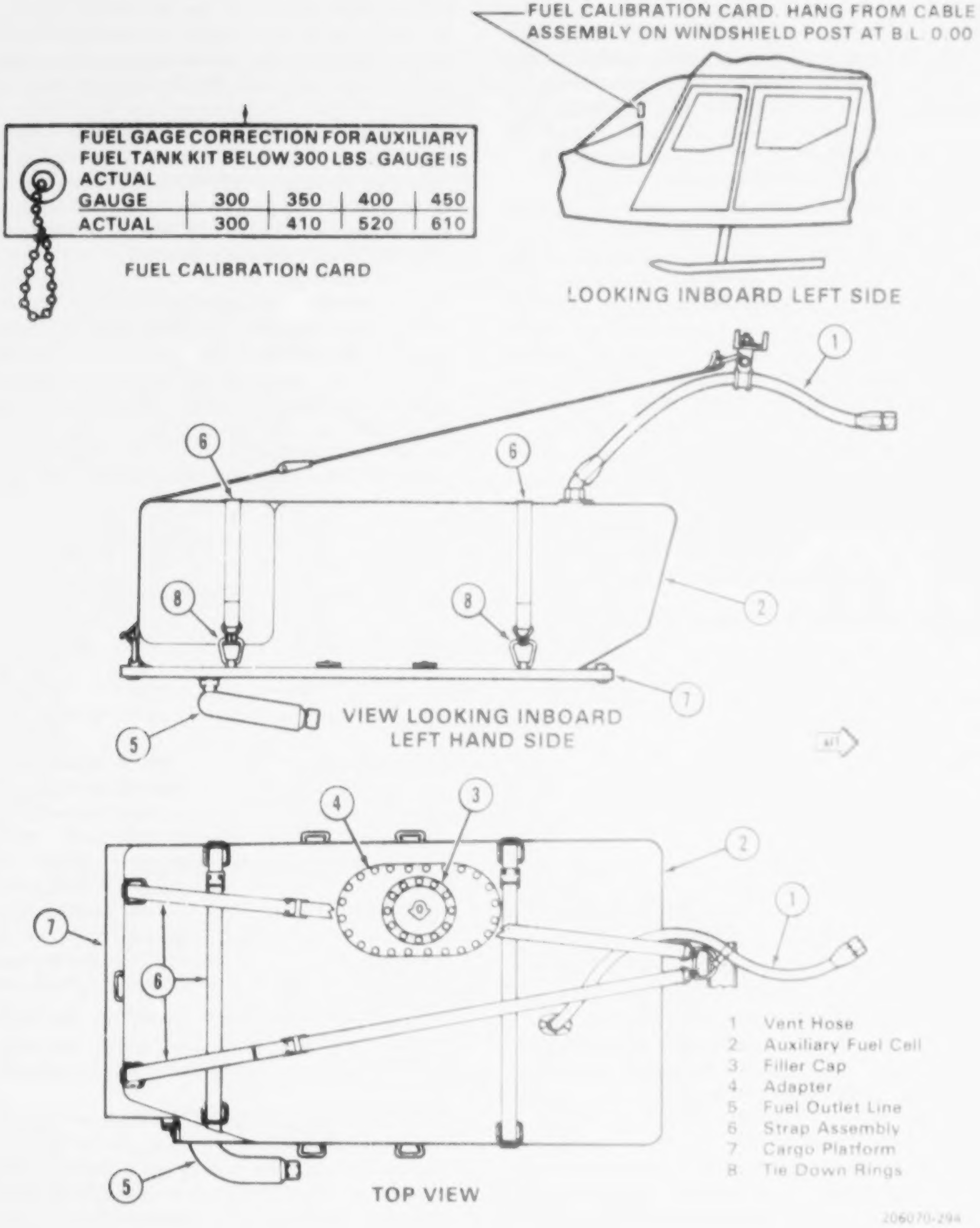
2-23. AUXILIARY FUEL SYSTEM.

An auxiliary fuel cell (figure 2-15) can be installed in the helicopter. The auxiliary fuel cell, when installed, is secured in the passenger compartment on the right half of the cargo platform. The auxiliary fuel cell is a self-supporting, crashworthy self-sealing bladder type.

a. This fuel is delivered to the main fuel system by gravity only; the pilot has no control over the flow of fuel from the auxiliary cell into the main fuel cell.

b. The auxiliary fuel cell can be filled either at the main fuel cell filler or at a filler cap on the auxiliary fuel cell. The preferred method is to service the helicopter with fuel at the main fuel filler.

c. When the auxiliary fuel cell is installed, a fuel calibration card must be used to determine the amount of fuel on board (figure 2-15).



FUEL GAGE CORRECTION FOR AUXILIARY FUEL TANK KIT BELOW 300 LBS. GAUGE IS ACTUAL

GAUGE	300	350	400	450
ACTUAL	300	410	520	610

FUEL CALIBRATION CARD. HANG FROM CABLE ASSEMBLY ON WINDSHIELD POST AT B.L. 0.00
FUEL CALIBRATION CARD
LOOKING INBOARD LEFT SIDE
VIEW LOOKING INBOARD LEFT HAND SIDE
TOP VIEW
1
2
3
4
5
6
7
8
1 Vent Hose
2 Auxiliary Fuel Cell
3 Filler Cap
4 Adapter
5 Fuel Outlet Line
6 Strap Assembly
7 Cargo Platform
8 Tie Down Rings
206070-294

Figure 2-15. Auxiliary Fuel System

2-24. CONTROLS AND INDICATORS.

a. **Fuel Quantity Indicator.** The FUEL QTY indicator (figure 2-13 and 2-14) is located in the instrument panel and displays the quantity of fuel in the fuel cell in pounds (0 to 600 lbs.). The indicator is powered by 28 Vdc and protected by INST CLUSTER circuit breaker A, FUEL QTY circuit breaker C.

b. **Fuel Boost Caution Light.** The FUEL BOOST caution light (figure 2-13 and 2-14) is located on the caution panel and illuminates if the fuel boost pressure is below safe operating limits when fuel boost switch is in the ON position. To check FUEL BOOST caution light with engine running, move FUEL BOOST switch, to ON. The FUEL BOOST caution light should illuminate then go OFF. The system is powered by 28 Vdc and protected by CAUTION PANEL LTS circuit breaker.

c. **Fuel Boost Pump Switch.** The FUEL BOOST switch (figure 2-13 and figure 2-14) is located in the lower right corner of the instrument panel. The fuel boost switch will be in the fuel boost position for all normal conditions when the engine is operating and for starting. The system is powered by 28 Vdc and protected by FUEL PUMP circuit breaker.

d. **Low Fuel Quantity Caution Light.** The 20 MIN FUEL caution light (figure 2-13 and figure 2-14), located in the caution panel, should illuminate when there is 65 to 97.5 pounds of total fuel remaining. The system is powered by 28 Vdc and protected by CAUTION PNL LTS circuit breaker.

e. **Fuel Filter Caution Light.** The FUEL FILTER caution light (figure 2-13 and figure 2-14), located in the caution panel, will illuminate when the filter in the fuel supply line becomes partially obstructed. The system is powered by 28 Vdc and protected by CAUTION PNL LTS circuit breaker. The light may illuminate momentarily when the boost pump is turned on, but it should extinguish within approximately ten seconds.

SECTION V. FLIGHT CONTROLS

2-25. DESCRIPTION.

CAUTION

When carrying non-rated passengers unfamiliar with the operation of the helicopter, the pilot should evaluate the mission as to the advantages and disadvantages of stowing the copilot controls or accepting the responsibility of the potential hazard when leaving the controls in place.

The flight control system is a positive mechanical type, actuated by conventional helicopter controls which, when moved, directs the helicopter in various modes of flight. Dual flight controls are provided. The system includes; the cyclic control stick, used for fore and aft and lateral control; the collective pitch control lever, used for vertical control; and the tail rotor anti-torque control pedals, used for heading control. The control forces of the main rotor flight control system are reduced to a near zero pounds force, to lessen pilot fatigue, by hydraulic servo cylinders connected to the control system mechanical linkage and powered by the transmission driven hydraulic pump. Force trims (force gradients) connected to the cyclic controls are electrically operated mechanical units used to induce artificial control feeling into the cyclic controls and to prevent the cyclic stick moving from a pre-set position.

2-26. CYCLIC CONTROL.

The pilot cyclic stick grip (figure 2-3 and figure 2-4) contains the FORCE TRIM release switch, RADIO/ICS, armament firing switch and gun elevate/depress switch. The cyclic control system controls the fore and aft and lateral movement of the helicopter. Control feel is provided by the force trim units.

NOTE

Removal of copilot cyclic stick can cause pilot cyclic stick to creep slightly aft.

a. **Copilot Cyclic Stick Stowage.**

NOTE

Force trim will be lost when the electrical connector is disconnected when stowing or removing the copilot cyclic stick. Removal is authorized by the pilot and/or commander. (Fuel quantity gage cannot be monitored with cyclic stick stowed C.)

(1) Unscrew retaining nut on cyclic stick.

(2) Secure cyclic stick on stowage pin and strap located on the left outboard side of the center console.

b. **Copilot Cyclic Stick Installation.**

(1) Remove cyclic stick from stowage.

(2) Insert cyclic stick into pivot assembly on torque tube.

(3) Secure cyclic stick in pivot assembly with knurled nut.

(4) Ensure electrical connector is installed.

2-27. COLLECTIVE PITCH CONTROL.

WARNING

Do not use deck under collective for storage. This could cause interference in the full down position.

The pilot collective pitch control is located to the left of the pilot position and controls the vertical mode of flight. A rotating grip-type throttle and a switch box assembly are located in the forward end of the pilot collective pitch lever (figure 2-3 and figure 2-4). The switch box assembly contains the starter, governor engine idle release and landing lights switches. Friction can be induced into the collective system by rotating a friction device located between the pilot and copilot seats. The copilot collective lever, located on the left of the copilot position, contains only a twist type throttle at the forward end of the control.

a. **Copilot Collective Pitch Control Stowage.**

(1) Remove the boot around copilot stick shaft.

(2) Loosen knurled nut at base of copilot stick. Remove stick.

(3) Stow stick in clips located on forward side of copilot seat.

b. **Copilot Collective Pitch Control Installation.**

(1) Remove stick from stowage clips and insert stick in jackshaft elbow assuring engagement of throttle tube.

(2) Secure stick in elbow with knurled nut.

(3) Secure boot around stick shaft.

2-28. ANTI-TORQUE (DIRECTION) CONTROL.

Anti-torque control pedals (figure 2-3 and figure 2-4) alter the pitch of the tail rotor blades and thereby provide the means of directional control. Pedal adjustments are located at the base of the pedals at floor level. Adjuster knobs enable adjustment of pedal distance for individual comfort.

a. **C Primary Directional Anti-Torque System.** The primary control normally transmits the control forces because it is more rigid than the backup system. The primary controls contain pilot controlled, electrically operated disconnects which permit the pilot to disengage the primary controls if they jam. If a jam occurs, the JAM light on the PRI DIR CONTR indicator panel will illuminate when the pilot applies approximately 50 pounds pedal force to the jammed controls. The pilot will then position the PRI DIR CONTR switch to DISENG. The JAM indicator light will go out and the DISENG indicator light will illuminate when disconnection of the jammed primary control has been completed. The backup control will take over the control function. In the event a separation occurs in the primary system control linkage, the backup control system immediately takes over the control function, no pilot response is required.

b. **C** **Vulnerability Reduction (Backup) Directional Anti-Torque System.** The backup control system used on this helicopter provides additional recovery options if the primary control system malfunctions. A jam in the backup control may cause the controls to be immovable at normal operating loads, but there will be no jam indication on the indicator panel. If a jam occurs, the shear links in the backup system will release when a pedal force of approximately 73 pounds is applied to the directional anti-torque control pedals. The primary controls will then be free to operate as normal. When a separation occurs in the backup control system, the primary control continues to maintain the control function.

2-29. FORCE TRIMS (FORCE GRADIENT).

Force gradient devices are incorporated in the controls. These devices are installed in the flight control system between the cyclic stick and the hydraulic power cylinder (servo). The devices act to furnish a force gradient of feel to the cyclic control stick. However, these forces can be reduced to zero by depressing the force trim button on the cyclic stick (figure 2-3 and figure 2-4). The gradient is accomplished by means of springs and magnetic brake release assemblies which enable the pilot to trim the controls, as desired, for any condition of flight. A FORCE TRIM toggle switch is installed in the control panel to activate the force trim system.

2-30. HORIZONTAL STABILIZER.

The horizontal stabilizer (figure 2-1 and figure 2-2) is located near the center of the tail boom and is installed in a predetermined fixed position. The horizontal stabilizer aids in trimming the helicopter in level flight and increases usable C.G. range.

2-31. VERTICAL FIN.

The vertical fin is located to the right of the tail rotor and is installed in a predetermined fixed position.

SECTION VI. HYDRAULIC SYSTEM

2-32. DESCRIPTION.

The hydraulic system consists of a variable delivery pump and reservoir, servo actuators with irreversible valve circuits for cyclic and collective controls, a pressure line filter, a return line filter, and a solenoid shutoff valve. The pump is located on the transmission. The hydraulic system provides for fully powered flight controls during autorotative flight.

2-33. CONTROL.

A hydraulic system switch (HYD BOOST) is located on the lower right portion of the instrument panel and controls the activation and deactivation of the hydraulic system. (Refer to figure 2-13 and figure 2-14.)

2-34. CAUTION INDICATOR.

A caution indicator is located on the caution panel to indicate when hydraulic pressure is low (figure 2-13 and figure 2-14).

SECTION VII. POWER TRAIN SYSTEM

2-35. TRANSMISSION.

The transmission is mounted on the cabin roof deck, forward of the power plant. The transmission transfers engine power to the main rotor through the mast assembly. The tail rotor is driven through the freewheeling unit, tail rotor driveshafts and tail rotor gearbox. Transmission lubrication is provided by a pump, relief valves, filter, spray jets, temperature bulb, and an oil cooler. The pump is a constant volume type driven by the accessory gear. An oil level sight gage is located on the right side of the transmission case. A breather type filler cap and two electrical magnetic chip detector drain plugs are incorporated. The transmission also furnishes lubrication for the freewheeling unit mounted in the engine accessory gearbox. Transmission oil is cooled by the oil cooler blower.

2-36. PYLON SUPPORT STRUCTURE.

a. The OH-58A/C has a design feature called a focused pylon mounting system for its pylon. This support concept differs from conventional four or five point spring mounting arrangements as follows:

(1) The pylon bi-pod supports aim or focus pylon input loads at the fuselage vertical center of gravity. The purpose is to reduce cabin vibration by eliminating pylon induced rolling moment about the center of gravity.

(2) Rigid mounting in the vertical plane minimizes vertical vibration.

(3) Vibration should not increase with mount aging as is possible with conventional spring mounted pylon supports.

b. The elastomeric mount provides pylon static centering.

2-37. PYLON SUSPENSION SYSTEM.

a. The main transmission is supported and attached at its lower rear section by an isolation mount. Bolted to the lower aft part of the transmission case is the drag pin which bolts to the elastomeric isolation mount.

b. The drag pin has a metal pin which is commonly referred to as the spike. The drag pin or spike physically is mounted so that "rides" inside the square metal opening of the transmission mount support.

c. The isolation mount is used to damped pylon to fuselage vibration and limit pylon rock. Movement of the transmission and isolation mount is limited by means of the drag pin (spike) which extends down into the transmission mount support mounted on the deck.

d. Contact between the drag pin and the transmission mount produces a noise known as spike knock.

2-38. FREEWHEELING ASSEMBLY.

The freewheeling unit is mounted in the accessory gearbox. Engine power is transmitted through the freewheeling unit to the main driveshaft and tail rotor driveshafts to provide power to the main and tail rotors respectively. During autorotation the freewheeling unit provides engine disconnect and the transmission drives the tail rotor.

2-39. TAIL ROTOR GEARBOX.

The gearbox is located near the vertical fin and provides a 90 degree change of direction of the tail rotor driveshaft. A breather type filler cap, electrical chip detector drain plug and an oil level sight gage are provided.

2-40. DRIVESHAFTS.

a. **Main Driveshaft.** The main driveshaft connects the engine output to the transmission.

b. **Tail Rotor Driveshaft.** The tail rotor driveshaft is made up of four sections; the forward short shaft, the oil cooler fan shaft, the aft short shaft, and the long shaft.

2-41. INDICATORS.

a. **Transmission Chip Detectors.** There are three chip detectors located within the transmission lubricating system. Two electrical chip detectors are located on the base of the transmission and are wired to the XMSN CHIP DET caution light and the MASTER CAUTION light. One magnetic chip detector is located on the freewheeling unit and is not connected to the caution lighting system. All three are provided to give evidence of ferrous metal particles in the transmission lubrication system.

b. **Tail Rotor Gearbox Chip Detector.** The chip detector is located in the lower section of the tail rotor gearbox. The chip detector is wired to the T/R CHIP DET caution light and the MASTER CAUTION light. The caution light is activated when a sufficient amount of metal particles has been collected on the chip detector to close the circuit.

c. **Transmission Oil Pressure Warning Light.** The XMSN OIL PRESS warning light (figure 2-13 and figure 2-14) is located in the upper center section A, and upper right corner C of the instrument panel. The XMSN OIL PRESS light will illuminate steady until oil pressure is above 36 psi. The transmission oil pressure switch is located on the left side of the cabin roof near the transmission. The light is protected by the CAUTION PNL LTS circuit breaker.

d. **Transmission Oil Temperature Warning Light.** The XMSN OIL HOT warning light (figure 2-13 and figure 2-14) is located in the upper center section A, and upper right corner C of the instrument panel. The XMSN OIL HOT light will illuminate steady until oil temperature is below 110°C. The transmission oil temperature sensor is located on the transmission oil filter head. The light is protected by the CAUTION PNL LTS circuit breaker.

SECTION VIII. MAIN AND TAIL ROTOR GROUPS

2-42. MAIN ROTOR.

The main rotor assembly is a two blade, semi-rigid, see-saw type rotor called an underslung feathering axis hub. The blades are mounted in the hub assembly grips with blade retaining bolts which have hollow shanks for installation of weights to balance the hub and blade assembly. Oil reservoirs, with sight gages, are provided for pitch change bearings in the two grips and for the two pillow block bearings utilized with the flapping axis trunnion. The rotor blades are all metal, consisting of an extruded aluminum alloy nose block, aluminum alloy trailing edge and an aluminum honeycomb filler. The main rotor is driven by the mast which is connected to the transmission. The rotor RPM is governed by the engine RPM during powered flight. The rotor tip path plane is controlled by the cyclic stick. The rotor pitch is controlled by the collective lever.

2-43. MAIN ROTOR RPM INDICATOR.

CAUTION

The same audio tone is used for both the rotor rpm warning and engine out warning. Check the visual indicators to determine the corrective action necessary.

The rotor tachometer indicator (figure 2-13 A, figure 2-14 C) is part of the dual tachometer and is located on the instrument panel. The rotor RPM reading is indicated on the inner scale and the pointer needle is marked with an R. The indicator is powered by a tachometer generator mounted on and driven by the transmission and is independent of the helicopter electrical system.

2-44. RPM WARNING SYSTEM.

A ROTOR RPM warning system is installed to provide a visual and audio indication of low rotor RPM. A RPM sensor is connected to the rotor tachometer. Power is supplied from the CAUTION PNL LTS circuit breaker and connections are made to the ROTOR RPM warning light and to a tone generator which provides an audible tone in the crews headsets. The warning system is activated when the rotor RPM drops below 335 ± 5 RPM.

2-45. TAIL ROTOR.

The tail rotor is driven by the inner shaft of the freewheeling unit through tail rotor driveshaft and the tail rotor gearbox. The tail rotor hub and blade assembly consists of an aluminum alloy forged yoke and aluminum alloy blades. The spherical bearings provide for pitch change of the blades. The hub and blade assembly are mounted on the tail rotor gearbox shaft by means of a splined trunnion, mounted in bearings in the yoke, to provide a flapping axis for the assembly. The tail rotor gearbox has a breather type fillter cap, electrical chip detector and oil level sight gage, all accessible from ground level. Tail rotor blade pitch is controlled by the anti-torque pedals.

SECTION IX. UTILITY SYSTEM

2-46. PITOT HEATING SYSTEM.

a. Description. The pitot heater is installed on the pitot head and functions to prevent ice forming in the pitot tube. Electric power for the pitot heater operation is supplied from the 28volt dc helicopter electrical system. Circuit protection is provided by a 5 ampere circuit breaker switch on the overhead console. The pitot heater is controlled by a switch located on the overhead console (figure 2-12) labeled PITOT HTR.

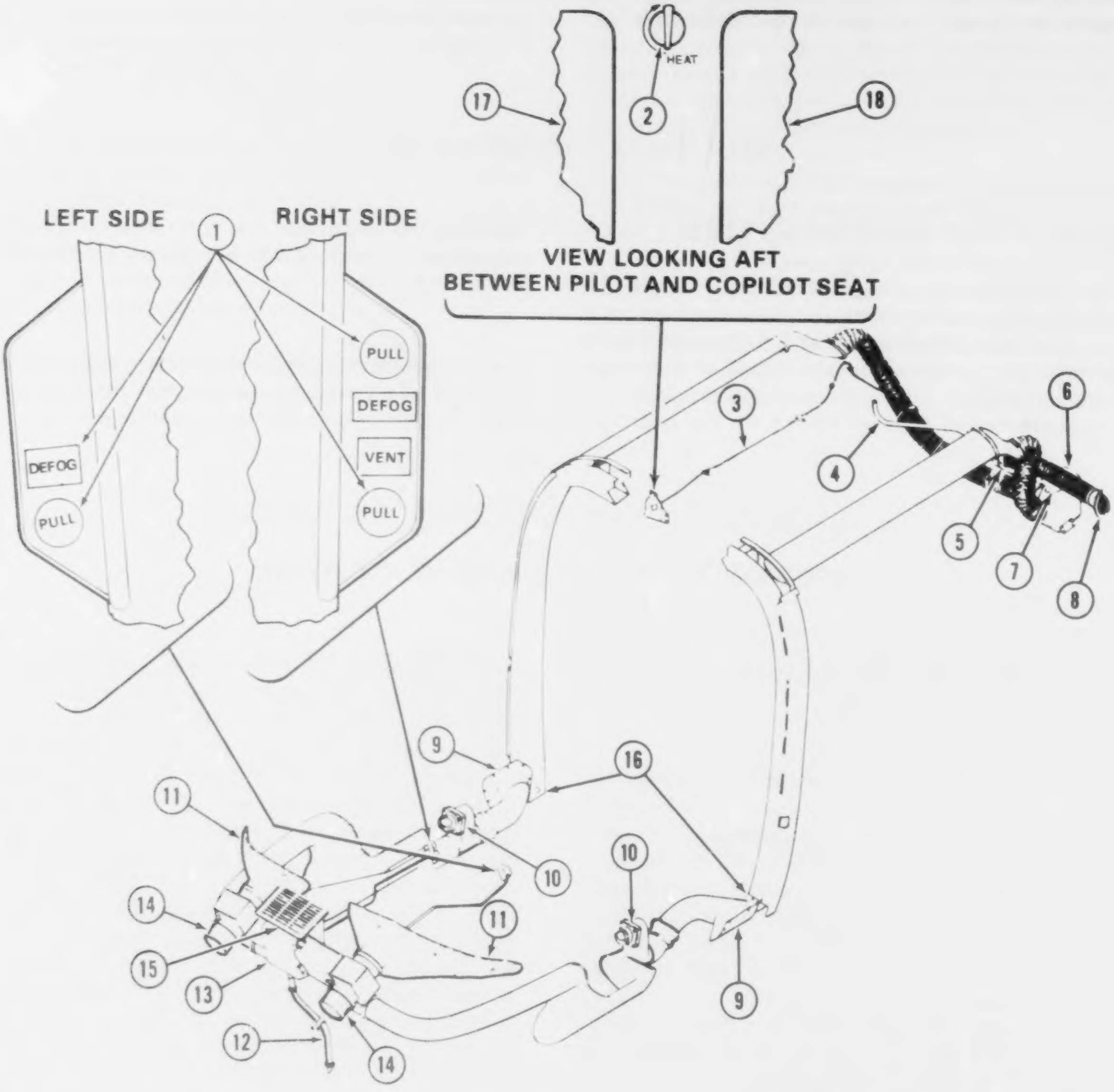
b. Operation. The pitot heater switch should be in PITOT HTR position to prevent ice forming in pitot tube. To shut off pitot heater, position switch to OFF.

SECTION X. HEATING AND VENTILATION

2-47. BLEED AIR HEATING SYSTEM.

a. Description. The bleed air heater is installed in the equipment compartment aft of the electrical shelf behind the passenger seat. A PITOT HTR circuit breaker switch (figure 2-11) located on the overhead console actuates the heater. The pilot may select air temperature by means of a HEAT control knob (figure 2-17) located above and aft of his head. This knob operates a control cable in the cabin roof to adjust an air temperature sensor mounted in the heater discharge duct. Adjusting the sensor mixes the fresh and bleed air to obtain the air temperature selected by the pilot. The bleed air heating ducts are connected to windshield defog nozzles at the bottom of the forward windshield through blowers mounted in the fuselage nose. The blowers are activated by DEFOG & VENT circuit breaker switch (figure 2-12) located on the overhead console to increase airflow velocity over the windshield. Lower nose window defog is continuous and automatic when HTR switch is turned on. Outside fresh air from an intake on the top of the fuselage nose is directed through the windshield defog nozzles mounted on the lower windshield frame. A VENT PULL control on the right side of the instrument panel (figure 2-16) opens and closes the fresh air intake.

b. Operation. A circuit breaker switch labeled HTR PWR on the overhead console (figure 2-12) actuates a solenoid valve. The switch in the ON position permits air from the engine compressor section to pass through the bleed air nozzle. A venturi working in conjunction with the bleed air nozzle draws in outside air through the outside air vent. Bleed air and outside air is fed into the mixing valve where a sensor determines the mixing ratio to produce the desired temperature. Bleed air forces heated air through the duct system to registers under the seat and/or to the defroster nozzles. Temperature is regulated by a manual control knob labeled HEAT located above and to the rear of the pilot's head, and connected to a variable remote sensor in the heater compartment. The sensor has a bi-metallic element which controls the mixing valve. The defogging and vent system is installed in the nose and consists of a ram air intake, two blower fans, defroster nozzles and ducts. The bleed air system is also connected to the defogging and vent system. Outside air flow to the cabin and defogging nozzles is controlled by manual push-pull type controls labeled VENT and DEFOG located on each side of the instrument panel. (Figure 2-16.) The blowers direct air to the defogging nozzles and are controlled by a 5 AMP circuit breaker switch, labeled DEFOG & VENT, on the overhead console. (Refer to figure 2-12.)


VIEW LOOKING AFT
BETWEEN PILOT AND COPILOT SEAT
HEAT
17
2
18
LEFT SIDE
1
RIGHT SIDE
PULL
DEFOG
VENT
DEFOG
PULL
PULL
3
6
4
5
7
8
9
16
11
10
10
14
11
15
13
9
12
14

1. Vent and Defog Control (Instrument Panel)
2. Heat Control
3. Heat Control Cable
4. Bleed Air Tube
5. Mixing Valve
6. Plenum
7. Remote Sensor
8. Fresh Air Inlet
9. Post Plenum
10. Air Distribution Valves
11. Windshield Defog Nozzle
12. Plenum Drain
13. Plenum Valve Assembly
14. Ventilating and Defogging Blower
15. Ram Air Intake Grill
16. Air Distribution Vents Cargo/Passenger Area
17. Pilot Seat Back (REF)
18. Copilot Seat Back (REF)

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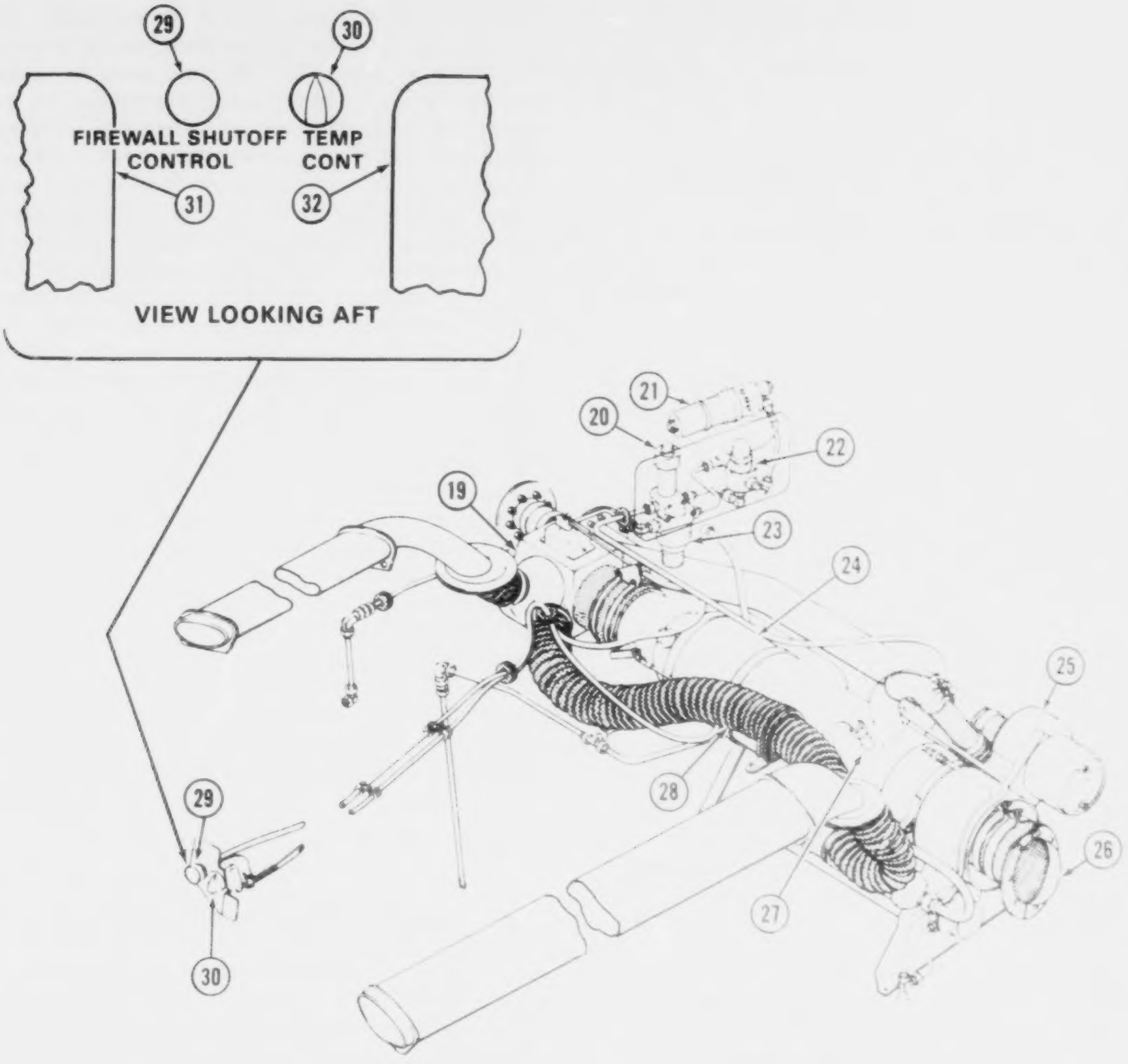
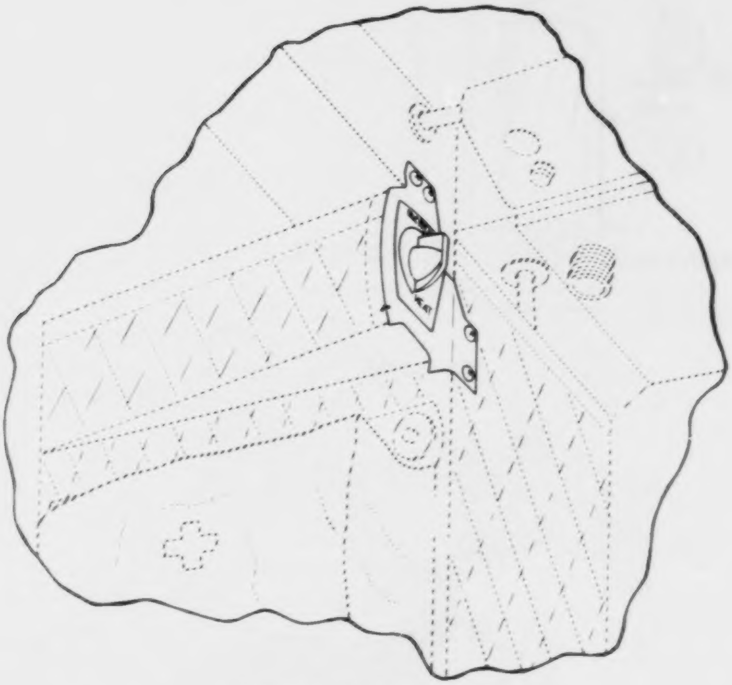
Figure 2-16. Heating and Ventilation **A** (Sheet 1 of 2)


29
30
FIREWALL SHUTOFF CONTROL
TEMP CONT
31
32
VIEW LOOKING AFT
21
20
22
19
23
24
25
28
29
26
27
30

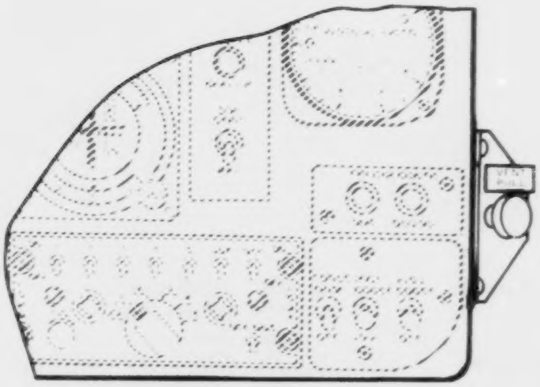
19. Combustion Heater Plenum
20. Fuel Shutoff Valve
21. Fuel Pump
22. Fuel Pressure Relief Valve
23. Fuel Filter
24. Heater
25. Combustion Blower
26. Air Scoop
27. Igniter Plug
28. Duct
29. Firewall Shutoff Control
30. Temperature Control
31. Pilot Seat Back
32. Copilot Seat Back

206900-511-2

Figure 2-16. Heating and Ventilation **A** (Sheet 2 of 2)



HEATER CONTROL KNOB



VENT PULL CONTROL KNOB

206070-295

Figure 2-17. Heater Control and Vent Pull Knobs C

2-48. A COMBUSTION HEATER.

a. **Description.** A combustion heater is installed on the electrical shelf behind the passenger seat, on helicopter serial Nos. 70-15263 thru 70-15278, in the aft equipment compartment. Fuel for heater operation is supplied by the helicopter fuel system and routed through the heater fuel filter, pump, relief valve, and shutoff valve. Ignition is supplied by a heater mounted ignition assembly which converts 28 volts DC to high voltage, producing a continuous spark during heater operation. Air is supplied by a blower through a port on the right side of the helicopter and routed to the combustion chamber. Heater exhaust gasses are piped overboard through a shrouded exhaust flue. Heated air is distributed by a heater mounted ventilating air blower and routed through ducts to the forward and aft cabin compartments. Two adjustable distribution valves are provided in the pilot compartment and two fixed openings for the passenger compartment. Controls for heater starting are located on the overhead panel and two controls are mounted on the vertical column on pilot seat back. The left side control is for temperature and the right side control operates the heater shutoff valve in the event of fumes, fire, or heater malfunction. A heater fail light is mounted on the console and will indicate heater malfunction. Consumption of fuel is 3.5 gallons per hour for 30,000 BTU heater and 4.5 gallons per hour for the 50,000 BTU heater. (Refer to figure 2-16.)

b. **Combustion Heater Pre-Start Check.**

(1) FUEL PUMP circuit breaker — In.

(2) HTR PWR circuit breaker — In.

(3) HTR CONT circuit breaker — In.

(4) FIREWALL SHUT-OFF CONTROL — In.

(5) BAT switch — BAT.

(6) FUEL VALVE — ON.

(7) HEAT-OFF-VENT switch — OFF.

c. **Normal Operation.**

(1) HEAT-OFF-VENT switch — ON. Check that combustion air and vent blowers operate and HEATER FAIL caution light is on.

(2) HTR START switch — Press and hold. Ignition should occur within 5 to 10 seconds. HEATER FAIL caution light should go off.

(3) TEMP CONT knob — Regulate for desired temperature.

(4) HEAT-OFF-VENT switch — OFF, to shut down heater.

NOTE

HEAT-OFF-VENT switch in OFF position, the combustion air and vent blowers will continue to operate, cooling and purging the heater, and will cut off automatically when the heater has cooled. If manual cooling and purging is desired place switch in VENT position, then return switch to OFF.

d. **Emergency Shutdown.**

(1) FIREWALL SHUT-OFF CONTROL knob — Release and pull out.

(2) HEAT-OFF-VENT switch — OFF.

SECTION XI. ELECTRICAL POWER SUPPLY AND DISTRIBUTION SYSTEM

2-49. DIRECT CURRENT PRIMARY POWER.

The OH-58A/C helicopter is equipped with a 28-volt direct current dual bus (essential and non-essential) system supplied by a starter-generator and battery (figure 2-18). Components of the direct current power system include battery, starter-generator, voltage regulator, relays, switches, and circuit breakers. All circuits in the electrical system are single wire with common ground return. The negative terminals of the starter-generator and the battery are grounded to the helicopter structure. In the event of generator failure, with the NON-ESS BUS switch in the NORM position, the non-essential bus is automatically deactivated. The battery then supplies power to the essential bus load. The non-essential bus may be manually reactivated by placing the NON-ESS BUS to the MAN position. In the event of engine failure, generator power will be lost.

a. **Indicators and Controls.**

(1) **DC System Indicator.** The ammeter is mounted in the instrument cluster on the instrument panel and indicates the ampere load being used. The circuit is protected by two circuit breakers, labeled LOADMETER in the aft electrical compartment.

(2) **DC Power Control.** The DC power is controlled by the BAT switch, GEN switch, NON-ESS BUS switch, and circuit breakers labeled GEN & BUS RESET and GEN FIELD.

(3) **Battery Switch.** The Battery switch is located in the overhead console and is a two-position toggle switch, labeled BAT and OFF. Battery electrical power is supplied to the helicopter electrical system when the switch is in the BAT position. When the switch is in the BAT position, it closes the circuit to the actuating coil of the battery relay and battery power is then delivered from the battery to the essential bus. When the switch is placed in the OFF position, it opens the circuit to the actuating coil of the battery relay and no power is delivered from the battery to the essential bus.

(4) **Generator Switch.** The generator switch is located on the overhead console and is a three-position switch. This switch is labeled GEN in the forward position, OFF in the center position and RESET in the aft position. The RESET position is spring loaded to return to the OFF position when released; therefore, to reset the generator the switch must be held in RESET position momentarily and then moved to the forward position.

(5) **Non-Essential Bus Switch.** The non-essential bus switch is located in the overhead console and is a two-position switch labeled NON-ESS BUS NORM and MAN. When the switch is in the NORM position, power is supplied to the non-essential bus provided the generator is operating or when external power is applied. When the switch is in the MAN position, power is supplied to the non-essential bus regardless of generator operation.

b. **Circuit Breakers.** The DC circuit breaker panel (figure 2-12) is located in the overhead console. Each individual circuit breaker is clearly labeled for the particular electrical circuit protected. In the event a circuit is overloaded, the circuit breaker protecting that circuit will deactivate. The circuit is reactivated by pushing the circuit breaker button.

c. **External Power Receptacle.** During ground operations, external power may be connected to the electrical system through an external power receptacle (figure 2-11) located on the lower right side of the helicopter just aft of the rear landing gear crosstube **A**, (figure 2-2) located on lower right side of the helicopter **C**. The GEN and BAT switches should be in the OFF position when external power is connected. The external power relay closes automatically and connects the ground unit to the essential and non-essential buses. A GPU power of 300 to 750 amperes and 28 vdc is recommended.

d. **Auxiliary Power Receptacle.** The auxiliary power receptacle is mounted on a bulkhead aft of the copilot seat and provides power take off of 28 Vdc to operate miscellaneous auxiliary equipment. The circuit is powered by 28 Vdc essential bus and is controlled and protected by AUX RECP circuit breaker switch on the overhead console.

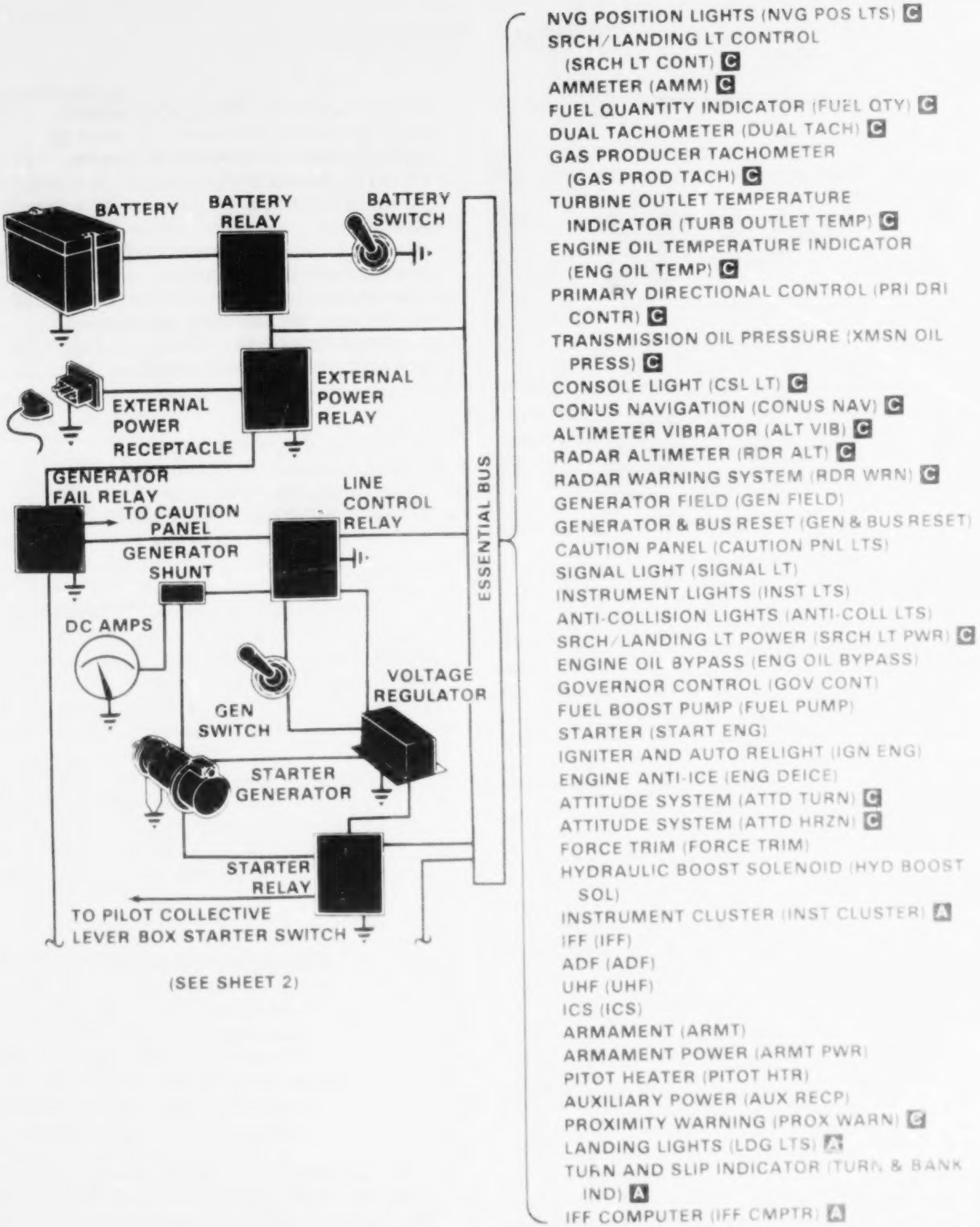

BATTERY
BATTERY RELAY
BATTERY SWITCH
EXTERNAL POWER RECEPTACLE
EXTERNAL POWER RELAY
GENERATOR FAIL RELAY
TO CAUTION PANEL
LINE CONTROL RELAY
GENERATOR SHUNT
DC AMPS
GEN SWITCH
VOLTAGE REGULATOR
STARTER GENERATOR
STARTER RELAY
TO PILOT COLLECTIVE LEVER BOX STARTER SWITCH
(SEE SHEET 2)
ESSENTIAL BUS
NVG POSITION LIGHTS (NVG POS LTS) C
SRCH/LANDING LT CONTROL (SRCH LT CONT) C
AMMETER (AMM) C
FUEL QUANTITY INDICATOR (FUEL QTY) C
DUAL TACHOMETER (DUAL TACH) C
GAS PRODUCER TACHOMETER (GAS PROD TACH) C
TURBINE OUTLET TEMPERATURE INDICATOR (TURB OUTLET TEMP) C
ENGINE OIL TEMPERATURE INDICATOR (ENG OIL TEMP) C
PRIMARY DIRECTIONAL CONTROL (PRI DRI CONTR) C
TRANSMISSION OIL PRESSURE (XMSN OIL PRESS) C
CONSOLE LIGHT (CSL LT) C
CONUS NAVIGATION (CONUS NAV) C
ALTIMETER VIBRATOR (ALT VIB) C
RADAR ALTIMETER (RDR ALT) C
RADAR WARNING SYSTEM (RDR WRN) C
GENERATOR FIELD (GEN FIELD)
GENERATOR & BUS RESET (GEN & BUS RESET)
CAUTION PANEL (CAUTION PNL LTS)
SIGNAL LIGHT (SIGNAL LT)
INSTRUMENT LIGHTS (INST LTS)
ANTI-COLLISION LIGHTS (ANTI-COLL LTS)
SRCH/LANDING LT POWER (SRCH LT PWR) C
ENGINE OIL BYPASS (ENG OIL BYPASS)
GOVERNOR CONTROL (GOV CONT)
FUEL BOOST PUMP (FUEL PUMP)
STARTER (START ENG)
IGNITER AND AUTO RELIGHT (IGN ENG)
ENGINE ANTI-ICE (ENG DEICE)
ATTITUDE SYSTEM (ATTD TURN) C
ATTITUDE SYSTEM (ATTD HRZN) C
FORCE TRIM (FORCE TRIM)
HYDRAULIC BOOST SOLENOID (HYD BOOST SOL)
INSTRUMENT CLUSTER (INST CLUSTER) A
IFF (IFF)
ADF (ADF)
UHF (UHF)
ICS (ICS)
ARMAMENT (ARMT)
ARMAMENT POWER (ARMT PWR)
PITOT HEATER (PITOT HTR)
AUXILIARY POWER (AUX RECP)
PROXIMITY WARNING (PROX WARN) C
LANDING LIGHTS (LDG LTS) A
TURN AND SLIP INDICATOR (TURN & BANK IND) A
IFF COMPUTER (IFF CMPTR) A
206475-235-1

Figure 2-18. Electrical System Schematic (Sheet 1 of 2)

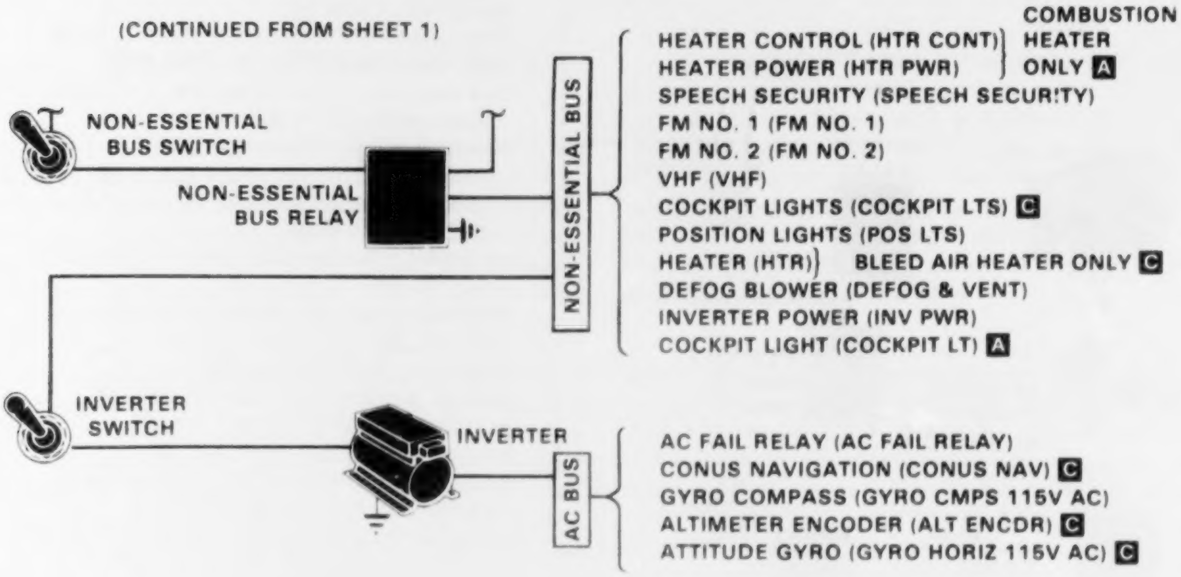

(CONTINUED FROM SHEET 1)
NON-ESSENTIAL BUS SWITCH
NON-ESSENTIAL BUS RELAY
NON-ESSENTIAL BUS
HEATER CONTROL (HTR CONT)
HEATER POWER (HTR PWR)
COMBUSTION HEATER ONLY A
SPEECH SECURITY (SPEECH SECURITY)
FM NO. 1 (FM NO. 1)
FM NO. 2 (FM NO. 2)
VHF (VHF)
COCKPIT LIGHTS (COCKPIT LTS) C
POSITION LIGHTS (POS LTS)
HEATER (HTR)
BLEED AIR HEATER ONLY C
DEFOG BLOWER (DEFOG & VENT)
INVERTER POWER (INV PWR)
COCKPIT LIGHT (COCKPIT LT) A
INVERTER SWITCH
INVERTER
AC BUS
AC FAIL RELAY (AC FAIL RELAY)
CONUS NAVIGATION (CONUS NAV) C
GYRO COMPASS (GYRO CMPS 115V AC)
ALTIMETER ENCODER (ALT ENCDR) C
ATTITUDE GYRO (GYRO HORIZ 115V AC) C
206475-235-2

Figure 2-18. Electrical System Schematic (Sheet 2 of 2)

2-50. ALTERNATING CURRENT POWER SUPPLY.

The OH-58A/C helicopter is equipped with a solid state inverter powered from the non-essential 28 volt DC bus through a 5 ampere INV PWR circuit breaker and is manually controlled by an INV switch (figure 2-12). The inverter delivers 115 volt AC 400 Hz to the 115 volt AC bus. A caution panel segment INST INVERTER will illuminate when AC power is lost.

a. **Controls.** The AC power is controlled by the INV switch and AC circuit breakers. The inverter switch is located in the overhead console and is a two-position toggle switch labeled INV and OFF. AC electrical power is provided to the electrical system when the switch is in the forward position. DC power to the inverter is supplied by the non-essential bus; therefore, to have AC power, electrical power must be available at the non-essential bus. When the switch is in the OFF position it opens the circuit to the inverter.

b. **Circuit Breakers.** The AC circuit breakers are on the aft end of the overhead console. In the event of a circuit overload, the circuit breaker protecting that circuit will pop out. The circuit is reactivated by pushing in the circuit breaker button.

SECTION XII. LIGHTING

2-51. POSITION LIGHTS.

The position lights consist of three lights (figure 2-1 and figure 2-2). A green light is located on the right horizontal stabilizer tip, a red light on the left horizontal stabilizer tip, and a white light on the aft end of the tailboom. Electrical power is supplied from the 28-volt DC non-essential bus. Circuit protection is provided by the POS LTS circuit breaker on the overhead console. The position lights are controlled by the POS LTS switch on the overhead console (figure 2-12). The switch is a three-position toggle switch with BRT (forward) DIM (center) and OFF (aft) positions.

2-52. C NVG POSITION LIGHTS.

Five, white IR position lights (NVG position lights) are mounted on the aircraft. Two forward NVG position lights (figure 2-2) are mounted forward of the FM homing antenna on both sides of the aircraft. Two lower NVG position lights (figure 2-2) are mounted forward of the APR-39 antenna support. One aft NVG position light is located on top of the tail light support assembly. Power for NVG position lights is provided by the NVG POS LTS circuit breaker (figure 2-12). Operation of the NVG position lights is controlled by a five-position rotary switch, NVG POS LTS, (figure 2-12) located on the overhead console. In position 1, the lights are at minimum intensity, in position BRT, the lights are at maximum intensity.

2-53. ANTI-COLLISION LIGHTS.

The anti-collision lights are located one on top of the engine cowling and one centered at the lower section of the fuselage aft of the avionics compartment. Electrical power for the anti-collision lights is provided by the 28-volt DC electrical system essential bus. The anti-collision light switch is located on the overhead console (figure 2-12). The switch is a two-position toggle type labeled ANTI-COLLISION LTS and OFF. The forward position energizes the anti-collision light circuit. Float equipped helicopters have lower light relocated from boom station 88.0 to boom station 103.0 A.

2-54. A LANDING LIGHTS.

Two fixed landing lights are located in the lower nose section of the helicopter. The lights are controlled by a switch labeled LDG LTS located on the pilot collective lever switch box (figure 2-3). The switch is labeled BOTH, DOWN, and OFF. The switch in BOTH position illuminates both landing lights. In the DOWN position only the forward landing light is illuminated. Electrical power is provided from the 28-volt dc electrical system essential bus. Helicopters which have been modified have a switch placarded BOTH, FORWARD, OFF. When the switch is in the FORWARD position, the rear mounted light which is the forward shining light should illuminate.

2-55. C LANDING LIGHTS.

a. **Controllable Landing Light.** This system consists of a single controllable light, located in the lower nose of the helicopter. The light is controlled by two switches located on the pilot collective pitch lever switch box. One switch is labeled ON, OFF, STOW, and the other EXT, L, R, RETR. The ON, OFF, STOW switch illuminates the light in the ON position, will turn it off when positioned to OFF, and when positioned to STOW, will retract and rotate the light to a level position. The EXT, L, R, RETR switch is a "spring loaded off" switch that will stop the light in any selected position by releasing the switch. The EXT position will extend the light approximately 120 degrees regardless of degrees of light rotation and when positioned to RETR, will retract the light regardless of degrees of light rotation. The L and R positions will rotate the light a full 360 degrees continuously in any extended or retracted position. When the light is extended less than 60 degrees and is rotated more than 90 degrees in either direction, the light will automatically extinguish. The light is controlled by a circuit breaker labeled LDG LT CONT and powered by a circuit breaker labeled LDG LT PWR. Both receive 28 Vdc from the essential bus.

b. **IR/White (Dual) Landing/Searchlight.** A dual light assembly with a white light on one side and IR light on the other side is mounted in the lower nose section of the helicopter (figure 2-2).

CAUTION

Do not illuminate IR light with light assembly fully retracted.

Power for the light assembly is provided by the SRCH LT CONT and SRCH LT PWR circuit breakers. One three-position switch and one four-position switch, co-located on the pilot collective lever (figure 2-4), are used to operate the light assembly.

CAUTION

Do not illuminate IR light with light assembly fully retracted.

The three-position switch LDG LT (ON-OFF-NVG) controls illumination of the white light (ON position) and the IR light (NVG position).

NOTE

White light will automatically extinguish when light rotates 90° right or left of center, if extended less than 60°.

The four-position switch LDG LT (EXT-RETR-L-R) provides extension, 360° rotation and retraction.

2-56. INSTRUMENT LIGHTS.

A The instrument lights are all on one circuit and are controlled by a rheostat switch labeled INST LTS on the overhead console (figure 2-12). Clockwise rotation of the rheostat knob activates the instrument panel circuit and increases brilliance. Counterclockwise rotation of the knob dims, with final movement (OFF) deactivating the electrical circuit from essential bus.

C NVG-compatible bezel lights and postlights provide instrument panel lighting (figure 2-4). The instrument panel lighting is controlled by the INST LT rheostat control (figure 2-12) and is powered by the INST LTS circuit breaker.

2-57. CONSOLE LIGHTS.

The console lights are all on one circuit and are controlled by a rheostat switch labeled CONSOLE LTS on the overhead console (figure 2-12). Clockwise rotation of the rheostat knob activates the console panel circuit and increases brilliance. Counterclockwise rotation of the knob dims, with final movement (OFF) deactivating the electrical circuit, located on essential bus.

a. A Night Vision Features (For Flights Using Night Vision Goggles (NVG). A switch is located on the overhead console to activate the night vision goggles lights. The NVG LTS/OFF switch is a two-position lock-type, which locks in the OFF position and must be pulled down to switch to the NVG LTS position (figure 2-12). The OFF position deactivates the night vision goggles lights and activates the red lighting. In the NVG LTS position, the upper and lower console lighting is deactivated and the NVG lights are activated. The console lights and NVG rheostats controls the brightness of the NVG lighting. A hinged light filter is attached to the instrument panel so it can be adjusted over the ROTOR RPM warning light of the warning panel (figure 2-13, item 8 and 9) for flights using NVG and adjusted away from the ROTOR RPM warning light for flights not using NVG. A hinged light filter is also attached to the instrument panel for the other warning lights, and master caution lights for use in the same manner.

b. C NVG-compatible panel lights provide lighting of the ICS boxes KY28 and the ADF REVR located in the aircraft. The console lighting is controlled by the CONSOLE LT rheostat (figure 2-12) and is powered by the CSL LT circuit breaker.

2-58. SIGNAL LIGHT RECEPTACLE.

A plug in type receptacle (figure 2-12) for a hand held signal light, is located at the aft end of the overhead console. Power is supplied from the essential bus.

2-59. COCKPIT UTILITY LIGHT.

A Cockpit Utility Lights. Two cockpit utility lights are located within easy reach of either crew member. One is located on the center post and the other on the overhead center beam behind the copilot. One has a light filter for use with flights using NVG when necessary. The lights may be hand held or positioned in their holder for direct beam direction. A rheostat switch is a part of each light assembly. Power is supplied from the non-essential bus through the COCKPIT LTS circuit breaker.

C Supplementary NVG-compatible cockpit lighting is provided by a utility light and three floodlights. The utility light is attached to a flexible gooseneck extension mounted on the centerpost between the pilot and copilot seats (figure 2-4). The flexible gooseneck holds the utility light in the position selected by the pilot or copilot. An extension cord allows removal of the utility light from the gooseneck for manual use. The light is equipped with a self-contained rheostat and has a rheostat override pushbutton that provides full lamp output regardless of knob setting. Power for the light is provided by the COCKPIT LTS circuit breaker. Three NVG-compatible floodlights are mounted on the glareshield (figure 2-4). Floodlight intensity is controlled by the CONSOLE LT rheostat. The floodlights are powered by CSL LTS circuit breaker (figure 2-12).

2-60. NVG-COMPATIBLE FILTERS.

WARNING

NVG-compatible flip filters are to remain in the open position (unfiltered) during day flight and night flight without night vision goggles.

NVG-compatible flip filters are mounted next to the master caution, caution advisory, RPM, and radar warning indicators (figure 2-13 and figure 2-14). The filters are positioned closed for NVG flight only.

SECTION XIII. FLIGHT INSTRUMENTS

2-61. AIRSPEED INDICATOR.

The airspeed indicator (figure 2-13 and figure 2-14) displays the air speed of the helicopter indicated in knots. The airspeed is obtained by measuring the difference between impact air pressure from the pitot tube and the static air pressure from the static ports.

2-62. AAU-31/A PNEUMATIC ALTIMETER.

1. **C** **Description.** The AAU-31/A pneumatic counter-drum-pointer altimeter is a precision pressure altimeter (figure 2-14). Pressure altitude is displayed by a 100-foot drum and a single pointer indicating hundreds of feet on a circular scale, with 50' center markings. Below an altitude of 10,000 feet, a diagonal warning symbol will appear on the 10,000-foot counter.

A barometric pressure setting knob is provided to insert the desired altimeter setting in inches of Hg. A DC powered vibrator operates inside the altimeter whenever aircraft power is on.

2. **C** **Operation.**

a. **Normal Operation.** The ALTVIB circuit breaker must be in. The altimeter indicates pneumatic altitude reference to the barometric pressure level as selected by the pilot. A vibrator, powered by the DC essential bus, is contained in the altimeter and requires a minimum of one minute warmup prior to checking or setting the altimeter.

b. **Abnormal Operation.** If the altimeter's internal vibrator becomes inoperative due to internal failure or DC power failure, the pointer and drum may momentarily hang up when passing from "9" through "0" (climbing) or from "0" through "9" (descending). This hang-up will cause lag, the magnitude of which will depend on the vertical velocity of the aircraft and the friction in the altimeter. Pilots should be especially watchful for this type failure when the minimum approach altitude lies within the "8" — "1" part of the scale (800-1100, 1800-2100, etc.).

2-63. PRESSURE ALTIMETER.

A The pressure altimeter (figure 2-13) furnishes direct readings of height above mean sea level when properly adjusted.

2-64. ATTITUDE INDICATOR.

A The attitude indicator (figure 2-13) displays the attitude of the helicopter. The indicator is self contained and is connected through circuit breakers on the overhead console to the 115-volt AC bus.

C The attitude indicator (figure 2-14) displays the helicopter pitch and roll attitudes in relation to the earth horizon. Pitch attitude is displayed by the motion of the sphere with respect to the miniature airplane. Roll attitude is displayed by the motion of the roll pointer with respect to the fixed roll scale. The sphere can be adjusted to zero indication by the pitch trim knob. The rate of turn pointer indicates in which direction and at what rate the helicopter is turning. The inclinometer indicates when the helicopter is in trim, either in a coordinated turn or in straight and level flight. The warning flag, attitude (ATT) and rate of turn pointer provide indication of system malfunctions. When the gyro is being caged or when 28 Vdc power is interrupted, the ATT flag will be in full view. The rate of turn pointer will be biased out of view when 28 Vdc is interrupted. The circuit is powered by 28 Vdc essential bus and protected by ATTD HRZN and ATTD TURN circuit breakers. The rate-of-turn pointer is driven by 115 VAC internal circuitry that derives rate-of-turn from the output synchro transmitter of the directional gyro magnetic compass.

2-65. TURN AND SLIP INDICATOR.

A The turn and slip indicator (figure 2-13) is controlled by a direct current electrically actuated gyro. This instrument has a needle (turn indicator) and a ball (slip indicator). Although needle and ball are combined in one instrument and are normally read and interpreted together, each has its own specific function and operates independently of the other. The ball indicates when the helicopter is in directional balance either in a turn or in straight and level flight. If the helicopter is yawing or slipping, the ball will be off center. The needle indicates in which direction and at what rate the helicopter is turning.

2-66. FREE AIR TEMPERATURE INDICATOR.

The bi-metal free air temperature indicator (figure 2-13 and figure 2-14) is in the windshield, and provides a direct reading of the outside air temperature.

2-67. MAGNETIC COMPASS.

The magnetic compass (figure 2-13 and figure 2-14) is a standard, non-stabilized, magnetic type instrument mounted on a support which is attached to the right side of the cabin structure forward of the pilot. The compass is used in conjunction with a compass correction card that is located near the compass. In aircraft with low reflective painted interior, the compass correction card will be located in the front of the logbook.

2-68. VERTICAL SPEED INDICATOR.

The vertical speed indicator (figure 2-13 and figure 2-14) displays the helicopter ascent and descent speed in feet per minute. The indicator is actuated by the rate of atmospheric pressure change.

2-69. C CONUS NAVIGATION SYSTEM (AN/ARN-123).

Refer to Chapter 3.

2-70. C RADAR ALTIMETER (AN/APN-209).

Refer to Chapter 3.

2-71. RADAR WARNING SYSTEM.

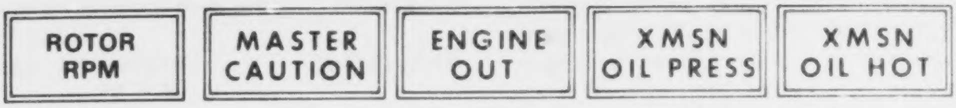
Refer to Chapter 3.

2-72. MISCELLANEOUS INDICATORS.

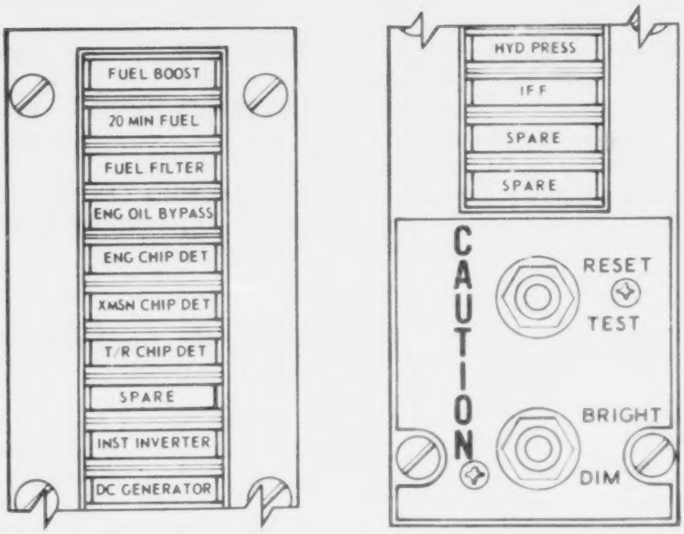
Instruments and indicators that are independent or are linked with more than one system are the clock and master caution and warning system (figure 2-12).

a. **Clock.** The clock (figure 2-13 and figure 2-14) has a sweep-second pointer and a minute totalizer hand to indicate elapsed time. The control knob in the upper right corner of the case starts, stops, and returns the pointers to the 12 o'clock position when actuated.

b. **Caution System.** The caution system (figure 2-13 and figure 2-14) is a segment wording type, consisting of a segment word warning CAUTION panel (figure 2-19) on the lower console and a remote MASTER CAUTION segment on the instrument panel. The purpose of the CAUTION system is to provide visual indication suitable for day or night operation, that a fault condition has occurred. In addition, a positive signal is provided to illuminate the remote MASTER CAUTION indicator. Each fault condition, as it occurs, is indicated by A, flashing of the lettering on the segment involved and by a flashing of the MASTER CAUTION indicator, C, steady illumination of the lettering on the segment involved and by a steady illumination of the MASTER CAUTION indicator. A momentary positioning of RESET-TEST switch to RESET extinguishes the MASTER CAUTION light so that it will illuminate for the next fault indication; also, the fault segment will be steadily ON. Segments will remain lighted as long as the fault condition(s) exist. Momentarily pressing the RESET-TEST switch to TEST will check if all caution lights are operational. Testing of the system will not change the existing fault conditions. The


ROTOR RPM
MASTER CAUTION
ENGINE OUT
XMSN OIL PRESS
XMSN OIL HOT

WARNING PANEL


FUEL BOOST
20 MIN FUEL
FUEL FILTER
ENG OIL BYPASS
ENG CHIP DET
XMSN CHIP DET
T/R CHIP DET
SPARE
INST INVERTER
DC GENERATOR
HYD PRESS
IFF
SPARE
SPARE
CAUTION
RESET
TEST
BRIGHT
DIM

CAUTION PANEL

CAUTION PANEL WORDING	FAULT CONDITIONS
FUEL BOOST	Fuel boost pump pressure is low.
20 MIN FUEL	Fuel quantity is below approximately 65 to 98 lbs.
FUEL FILTER	Fuel filter is partially obstructed.
ENG OIL BYPASS	Engine oil is at dangerously low level and/or oil is bypassing oil cooler.
ENG CHIP DET	Metal particles are in engine.
XMSN CHIP DET	Metal particles are in transmission.
T/R CHIP DET	Metal particles are in tail rotor gearbox.
INST INVERTER	Ac inverter has failed.
DC GENERATOR	Dc generator has failed.
HYD PRESS	Hydraulic pressure is low.
IFF	IFF system is inoperative.

NOTE: WITH NVG FLIP FILTERS INSTALLED **C**

206075-252

Figure 2-19. Warning and Caution Panels

BRIGHT-DIM switch (figure 2-19) controls the brightness of the caution panel lights and the MASTER CAUTION light. The INST LTS switch must be moved from the DIM position before the caution panel lights can be dimmed. The system is so designed that after each initial application of power, the lamps will illuminate in the bright condition.

c. **Warning System.** The warning system consists of five individually illuminated warning light segments mounted in the MASTER CAUTION and warning light panel (figure 2-19) on the instrument panel. The purpose of this system is to provide visual indication for day or night operation that any of the five conditions or combinations thereof has occurred. Each fault condition as it occurs is indicated by a steady illumination of the lettering on the particular segment. In addition, an audio signal sounds when the ENGINE OUT or ROTOR RPM segment is illuminated and the collective pitch is not in the full down position. The warning indicator segment remains illuminated until the fault condition is corrected.

ENGINE OUT	Engine N1 speed below 55 ± 3%.
XMSN OIL PRESS	Transmission oil pressure dangerously low.
XMSN OIL HOT	Transmission dangerously hot.
ROTOR RPM	Rotor rpm low.
MASTER CAUTION	Fault condition in caution panel.

The WARNING LTS TEST switch (figure 2-13 and figure 2-14) is pressed to check for illumination of all the warning lights.

SECTION XIV. SERVICING, PARKING, AND MOORING

2-73. SERVICING.

a. **Servicing Diagram.** Refer to figure 2-20 and figure 2-21.

b. **Fuels, Oils, Fluids, Specifications, and Capacities.** Refer to table 2-1.

2-74. APPROVED FUELS, OILS, AND FLUIDS.

a. **Fuels.** Refer to table 2-2.

b. **Oils.** Refer to table 2-3.

c. **Fluids.** Refer to table 2-4.

2-75. FUEL TYPES. See table 2-2.

a. **Primary or Standard Fuel.** JP-4 is designated as the Army standard fuel to be used in this aircraft. JP-4 contains icing inhibitor blended at the refinery. Commercial Jet B is a JP-4 type fuel; its mixture might or might not contain icing inhibitor.

b. **Alternate Fuel.** JP-5 and JP-8 are designated as the alternate fuel to be used in this aircraft. JP-5 and JP-8 contain icing inhibitor blended at the refinery. Jet A and Jet A1 are JP-5 type fuels without icing inhibitor.

c. **Emergency Fuel.** Aviation gasolines (MIL-G-5572) without Tricresyl Phosphate (TCP) are designated as the emergency fuels to be used in this aircraft.

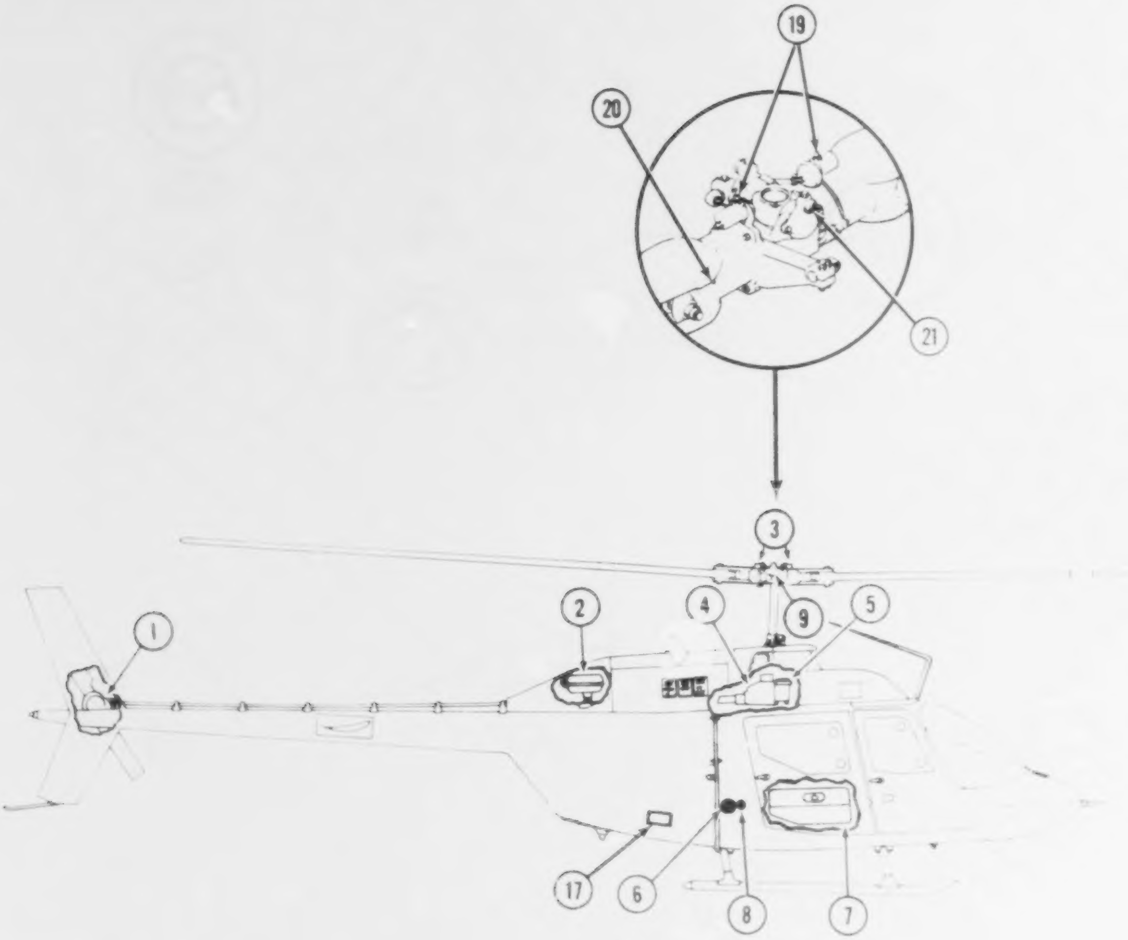
2-76. USE OF FUELS.

a. There is no special limitation on the use of Army standard fuel, but certain limitations are imposed when alternate or emergency fuels are used. For the purpose of recording, fuel mixtures shall be identified as to the major component of the mixture except when the mixture contains emergency fuel.

b. **Alternate Fuels.** JP-5, JP-8, Jet A, and Jet A-1 are alternate fuels. They may be added to JP-4 and to each other in any quantities. These fuels when used individually or as a mixture in any quantity must be recorded as alternate fuel on DA Form 2408-13.

c. **Emergency Fuels.** Aviation gasoline may also be added to turbine engine fuels in any quantity. Fuel mixtures containing any amount of Aviation Gasoline must be recorded in the Remark Section of DA Form 2408-13 as an emergency fuel, noting the type of fuel, additives, and duration of operation. The 6 hour total engine operation limitation applies.

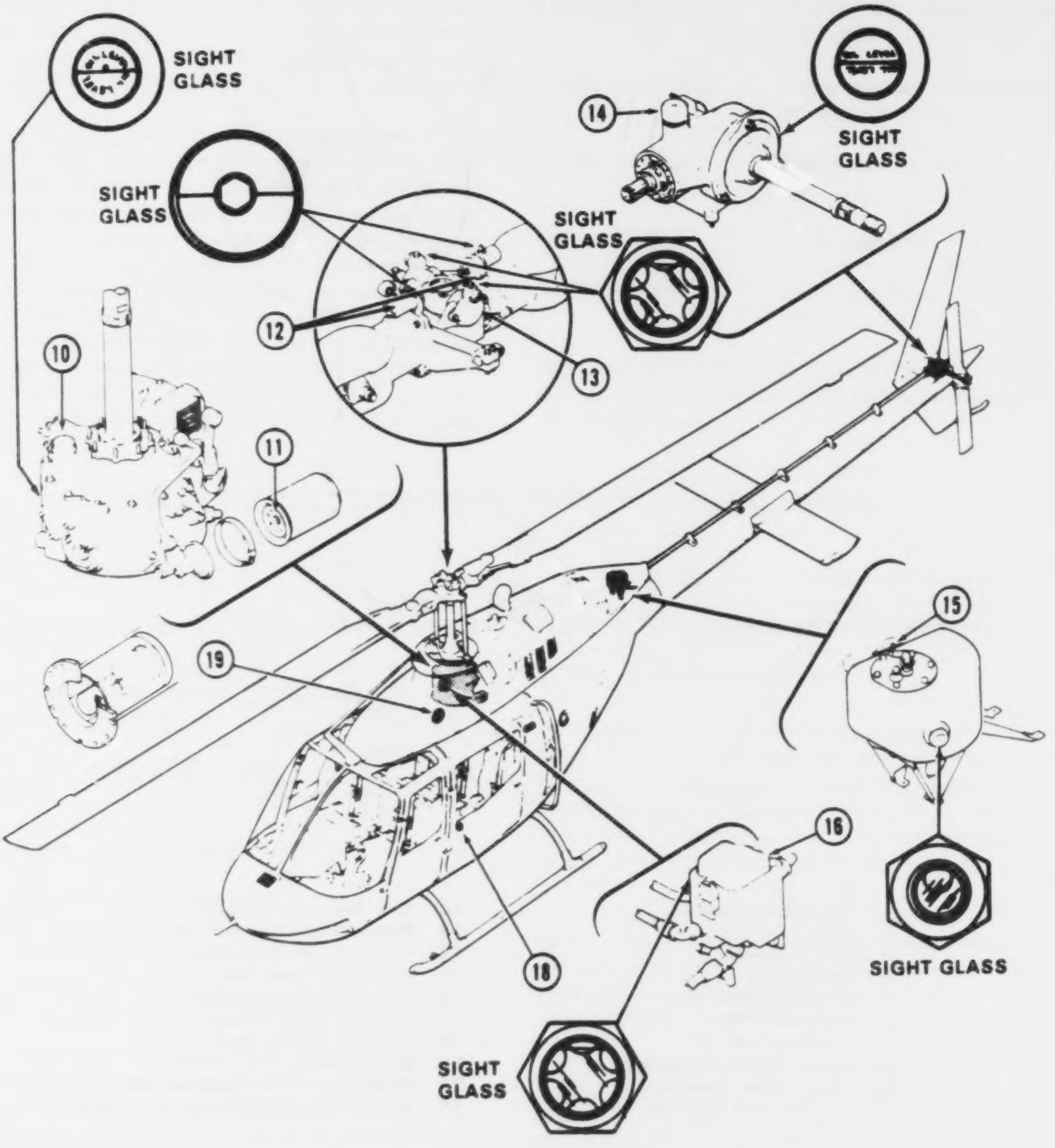
d. Refer to fuel operation limits, Chapter 5, when alternate and emergency fuels are used.



1. Tail Rotor Gearbox
2. Engine Oil Tank
3. Grip Reservoirs
4. Transmission
5. Hydraulic Reservoir
6. Fuel Tank Filler
7. Auxiliary Fuel Cell
8. Static Ground Receptacle
9. Pillow Block Reservoirs
10. Transmission Oil Filler
11. Oil Filter
12. Grip Reservoir (Oil Lubricated)
13. Pillow Block Reservoir (Oil Lubricated)
14. Tail Rotor Gearbox Filler
15. Engine Oil Tank Filler
16. Hydraulic Reservoir Filler
17. External Power Receptacle
18. Fuel Cell Sump Drain Valve
19. Relief Valve
20. Fitting Lubrication (Grease Lubrication)
21. Fitting Lubrication (Grease Lubrication)

206900-512-1

Figure 2-20. Servicing Diagram **A** (Sheet 1 of 2)


SIGHT GLASS
14
SIGHT GLASS
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SIGHT GLASS
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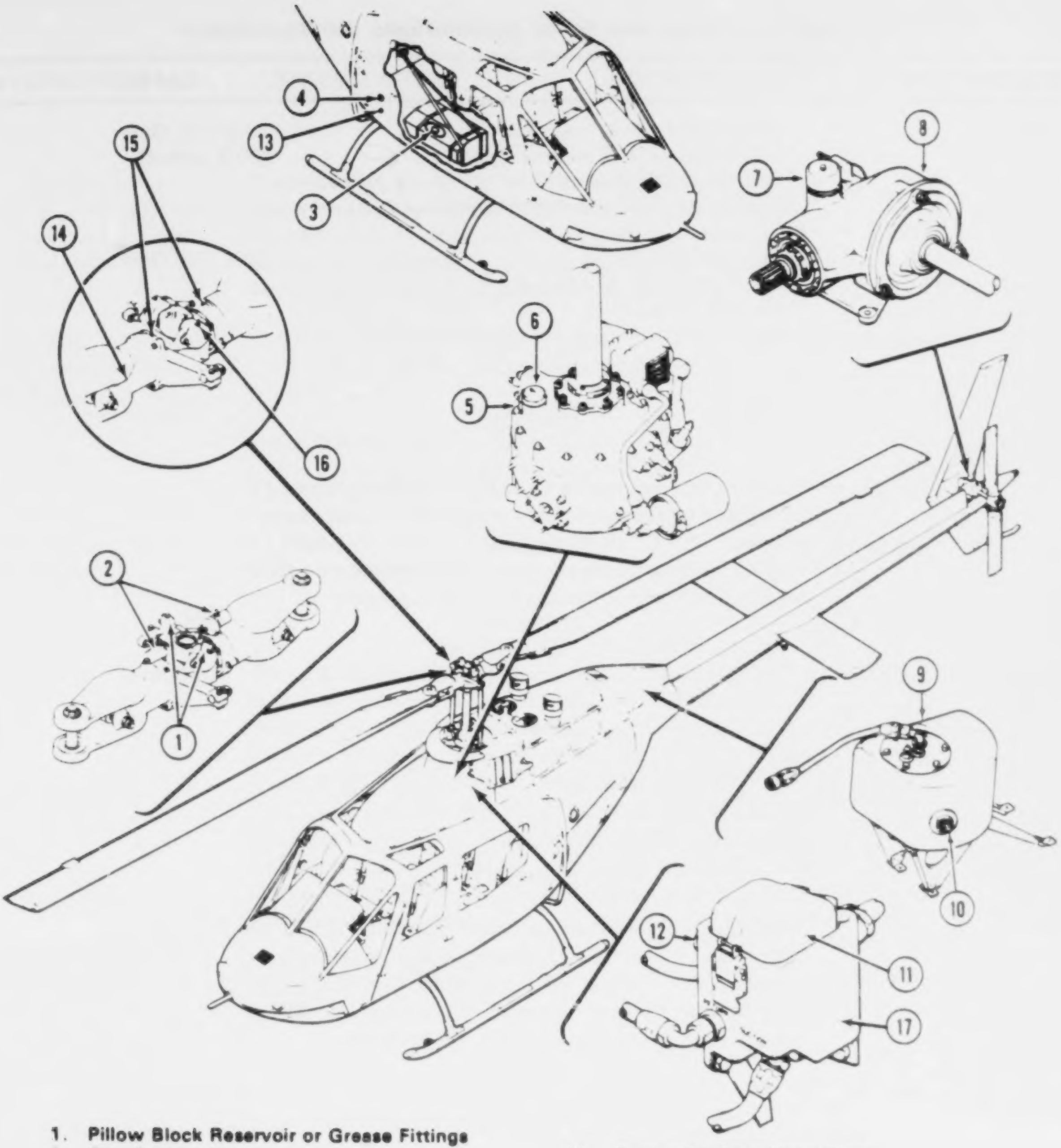
SIGHT GLASS
SIGHT GLASS
206900-512-2

Figure 2-20. Servicing Diagram A (Sheet 2 of 2)



1. Pillow Block Reservoir or Grease Fittings
2. Grip Reservoir
3. Auxiliary Fuel Filler Cap
4. Closed Circuit Refueling Receiver
5. Transmission Sight Glass
6. Transmitter Filler Cap
7. Tail Rotor Gearbox Filler Cap
8. Tail Rotor Gearbox Sight Glass
9. Engine Oil Filler Cap
10. Engine Oil Tank Sight Glass
11. Hydraulic Filler Cap
12. Hydraulic Sight Glass
13. Grounding Point
14. Fitting Lubrication (Grease Lubricated Hub)
15. Relief Valve (Grease Lubricated Hub)
16. Fitting Lubrication (Grease Lubricated Hub)
17. Hydraulic Reservoir

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Figure 2-21. Servicing Diagram **C**

Table 2-1. Fuels, Oils, Fluids, Specifications, and Capacities

SYSTEM	SPECIFICATION	CAPACITY
Fuel (Note 1)	MIL-T-5624 (JP-4) MIL-T-5624 (JP-5) Alternate fuel MIL-T-83133 (JP-8) MIL-G-5572 (without TCP) Emergency fuel	71.5 U.S. Gals (70.3 usable)
Fuel (Auxiliary Fuel Cell) (Note 1)	MIL-T-5624 (JP-4) MIL-T-5624 (JP-5) Alternate fuel MIL-T-83133 (JP-8) MIL-G-5572 (without TCP) Emergency fuel	23.9 U.S. Gals

CAUTION

***Lubrication oil made to MIL-L-7808 by Shell Oil Company under their part number 307, qualification number 7D-1, shall not be used in OH-58A/C engine or helicopter systems. It contains additives which are harmful to seals in the systems.**

SYSTEM	SPECIFICATION	CAPACITY
Engine Oil (Note 2)	*MIL-L-7808 NATO Code is 0-148 For use in ambient temperatures below minus 32°C/25°F MIL-23699 NATO Code is 0-156 For use in ambient temperatures above minus 32°C/25°F	Not Applicable

CAUTION

***Lubrication oil made to MIL-L-7808 by Shell Oil Company under their part number 307, qualification number 7D-1 shall not be used in OH-58A/C engine or helicopter systems. It contains additives which are harmful to seals in the systems.**

SYSTEM	SPECIFICATION	CAPACITY
Transmission Oil (Note 2)	*MIL-L-7808 NATO Code is 0-148 For use in ambient temperatures below minus 32°C/25°F MIL-23699 NATO Code is 0-156 For use in ambient temperatures above minus 32°C/25°F	Not Applicable

Table 2-1. Fuels, Oils, Fluids, Specifications, and Capacities (Cont)

SYSTEM	SPECIFICATION	CAPACITY

CAUTION

***Lubrication oil made to MIL-L-7808 by Shell Oil Company under their part number 307, qualification number 7D-1 shall not be used in OH-58A/C engine or helicopter systems. It contains additives which are harmful to seals in the systems.**

SYSTEM	SPECIFICATION	CAPACITY
Tail Rotor Transmission Oil (Note 2)	*MIL-L-7808 NATO Code is 0-148 For use in ambient temperatures below minus 32°C/25°F MIL-23699 NATO Code is 0-156 For use in ambient temperatures above minus 32°C/25°F	Not Applicable
Main Rotor Reservoirs	Primary — MIL-L-2104, Grade 30 Alternate SAE 30 Motor Oil HD	Not Applicable

WARNING

Prolonged contact with hydraulic fluid liquid or mist can irritate eyes and skin. After any prolonged contact with skin, immediately wash contacted area with soap and water. If liquid contacts eyes, flush immediately with clear water. If liquid is swallowed, do not induce vomiting; get immediate medical attention. Wear rubber gloves when handling liquid. If prolonged contact with mist is likely, wear an appropriate respirator. When fluid is decomposed by heating, toxic gases are released.

SYSTEM	SPECIFICATION	CAPACITY
Hydraulic Fluid Reservoir	MIL-H-5606 (Note 3) MIL-H-83282 (Note 4)	Not Applicable

NOTE:

1. See Chapter 5 for operating limits.
2. When oil is mixed or changed from one type to the other enter on DA Form 2408-13
3. For use in ambient temperatures below -40°F
4. Mixing of hydraulic fluids is authorized only in emergency situations. An entry in the remarks section of DA Form 2408-13 is required.

Table 2-2. Approved Fuels

SOURCE	PRIMARY OR STANDARD FUEL	ALTERNATE FUEL	
US MILITARY NATO CODE NO.	JP-4 (MIL-T-5624) F40 (WIDE CUT TYPE)	JP-5 (MIL-T-5624) or JP-8 (MIL-T-83133) F-44 or F-43 (HIGH FLASH TYPE)	
COMMERCIAL FUEL ASTM-D-1655)	JET B	JET A	JET A-1 NATO F-34
American Oil Co.	American JP-4	American Type A	
Atlantic Richfield	Arcojet B	Arcojet A	Arcojet A-1
Richfield Div.		Richfield A	Richfield A-1
B.P. Trading	B.P.A.T.C.		B.P.A.T.K.
Caltex Petroleum Corp.	Caltex Jet B		Caltex Jet A-1
Cities Service Co.		CITGO A	
Continental Oil Co.	Conoco JP-4	Conoco Jet-50	Conoco Jet-60
Gulf Oil	Gulf Jet B	Gulf Jet A	Gulf Jet A-1
EXXON Co. USA	EXXON Turbo Fuel B	EXXON A	EXXON A-1
Mobil Oil	Mobil Jet B	Mobil Jet A	Mobil Jet A-1
Phillips Petroleum	Philjet JP-4	Philjet A-50	
Shell Oil	Aeroshell JP-4	Aeroshell 640	Aeroshell 650
Sinclair		Superjet A	Superjet A-1
Standard Oil Co.		Jet A Kerosene	Jet A-1 Kerosene
Chevron	Chevron B	Chevron A-50	Jet A-1
Texaco	Texaco Avjet B	Avjet A	Avjet A-1
Union Oil	Union JP-4	76 Turbine Fuel	
FOREIGN FUEL	NATO F-40	NATO F-44	
Belgium	BA-PF-2B		
Canada	3GP-22F	3-6P-24e	
Denmark	JP-4 MIL-T-5624		
France	Air 3407A		
Germany (West)	VTL-9130-006	UTL-9130-007/UTL-9130-010	
Greece	JP-4 MIL-T-5624		
Italy	AA-M-C-1421	AMC-143	
Netherlands	JP-4 MIL-T-5624	D. Eng RD 2493	
Norway	JP-4 MIL-T-5624		
Portugal	JP-4 MIL-T-5624		
Turkey	JP-4 MIL-T-5624		
United Kingdom (Britain)	D. Eng RD 2454	D. Eng RD 2498	

NOTE

Anti-icing and Biocidal Additive for Commercial Turbine Engine Fuel — The fuel system icing inhibitor shall conform to MIL-I-27686. The additive provides anti-icing protection and also functions as a biocide to kill microbial growths in aircraft fuel systems. Icing inhibitor conforming to MIL-I-27686 shall be added to commercial fuel, not containing an icing inhibitor, during refueling operations, regardless of ambient temperatures. Refueling operations shall be accomplished in accordance with accepted commercial procedures. This additive (prist or ec.) is not available in the Army Supply System, but will be locally procured when needed.

Table 2-3. Approved Oils

APPROVED COMMERCIAL MIL-L-7808 TYPE OILS

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
American Oil and Supply Co.	PQ Turbine Oil 8365
Humble Oil and Refining Co.	ESSO/ENCO Turbo Oil 2389
Mobil Oil Corp.	RM-184A/RM-201A

CAUTION

Do not use Shell Oil Co., part No 307, qualification No. 7D-1 oil (MIL-L-7808). It can be harmful to seals made of silicone.

APPROVED COMMERCIAL MIL-L-23699 TYPE OILS

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
American Oil and Supply Co.	PQ Turbine Lubricant 5247/6423/6700/7731/8878/9595
Bray Oil Co.	Brayco 899/899-G/899-S
Castrol Oil Co.	Castrol 205
Chevron International Oil Co., Inc.	Jet Engine Oil 5
Crew Chemical Corp.	STO-21919/STO-21919A/STD 6530
W.R. Grace and Co. (Hatco Chemical Div.)	HATCOL 3211/3611
Exxon	Turbo Oil 2380 (WS-6000)/2395 (WS-6459)/2392/2393
Mobile Oil Corp.	RM-139A/RM-147A/Avrex S Turbo 260/Avrex S Turbo 265
Royal Lubricants Co.	Royco 899 (C-915)/899SC/Stauffer Jet II
Shell Oil Co., Inc.	Aeroshell Turbine Oil 500
Shell International Petroleum Co., Ltd.	Aeroshell Turbine Oil 550
Standard Oil Co. of California	Chevron Jet Engine Oil 5
Stauffer Chemical Co.	Stauffer 6924/Jet II
Texaco, Inc.	SATO 7377/7730/TL-8090

Table 2-4. Approved Fluids

APPROVED COMMERCIAL MIL-H-5606 TYPE FLUIDS

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
American Oil and Supply Co.	"PO" 4226
Bray Oil Co.	Brayco 757B Brayco 756C Brayco 756D
Castrol Oils, Inc.	Hyspin A
Humble Oil and Refining Co.	Univis J41
Mobile Oil Corp.	Aero HFB
Pennsylvania Refining Co.	Petrofluid 5606B Petrofluid 4607
Royal Lubricants Co.	Royco 756C/D DS-437
Shell Oil Co.	XSL 7828
Standard Oil Co., of California	PED 3565 PED 3337
Texaco, Inc.	TL-5874
Stauffer Chemical Co.	Aero Hydroil 500
Union Carbide Chemical Co.	YT-283
Union Carbide Corp.	FP-221

NOTE

Mixing of hydraulic fluids is authorized only in emergency situations. An entry in the remarks section of DA Form 2408-13 is required.

APPROVED COMMERCIAL MIL-H-83282 TYPE FLUIDS

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
Bray Oil Co.	Micronic 882
Royal Lubricants Co.	Royco 782
Hanover Processing Co.	Hanover R-2 HF 832

Table 2-4. Approved Fluids (Cont)

APPROVED COMMERCIAL MIL-H-83282 TYPE FLUIDS (Cont)

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
Gulf Oil Chemicals Co.	TS 741
Penreco	Petrofluid 822
Shell International Petroleum Co.	Aeroshell Fluid 31
American Oil and Supply Co.	PQ3883 PQ4219 PQ4268 PQ4362C PQ4401
NYCO S.A.	Hydraunycoil FH2
Emery Industries, Inc.	Emery 2946
Hatco Chemical Co.	Hatcol 4283

WARNING

Prolonged contact with liquid or mist can irritate eyes and skin. After any prolonged contact with skin, immediately wash contacted area with soap and water. If liquid contacts eyes, flush immediately with clear water. If liquid is swallowed, do not induce vomiting; get immediate medical attention. Wear rubber gloves when handling liquid. If prolonged contact with mist is likely, wear an appropriate respirator. When fluid is decomposed by heating, toxic gasses are released.

NOTE

Mixing of hydraulic fluids is authorized only in emergency situations. An entry in the Remarks Section of DA Form 2408-13 is required.

2-77. FUEL SYSTEM SERVICING. (POWER OFF)

a. Precautions.

NOTE

Servicing personnel shall comply with all safety precautions and procedures in FM 10-68.

(1) Be sure battery switch is in OFF position and external power is disconnected before fueling or defueling the helicopter.

(2) Ground the helicopter at the receptacle located adjacent to the filler cap on the helicopter to the filler-nozzle before removing filler cap.

(3) Servicing unit shall be grounded (servicing unit to ground and servicing unit to helicopter). The helicopter should be grounded to the same ground point as is the servicing unit.

(4) After completion of servicing, remove nozzle, reinstall cap and disconnect all grounds from helicopter. Wash down and remove any spillover of jet fuel. This fuel does not evaporate as rapidly as gasoline, and constitutes a fire hazard for a much longer time. Cleaning materials or clothing which have become saturated with jet fuel shall be disposed of well away from the helicopter or hangar.

b. Servicing.

CAUTION

Internal fuel cell hoses and clamps can be jarred loose with fuel nozzles. Insert nozzle carefully in a generally downward direction, avoiding contact with internal fuel hoses. Fuel nozzles must be hand held during servicing.

(1) Fill tank cells with specified fuel. Refer to table 2-1.

WARNING

In the event of major spillage of fuel, all powered equipment will be shut down. All personnel will leave the vicinity and be positioned to prevent any sources of possible ignition from entering area. The fire department will be summoned to the area to render safety.

NOTE

Settling time for AVGAS is 15 minutes per foot of tank depth and one hour per foot depth for jet (JP) fuels. Allow the fuel to settle for the prescribed period before any fuel samples are taken. (Approximately three hours for JP fuel.)

(2) Refer to table 2-1 for fuel tank capacity.

c. Close Circuit Refueling.

CAUTION

The closed circuit refueling receptacle is subject to damage at the gravity refueling port. Refer to figure 2-22. This damage can cause external fuel leakage during subsequent closed circuit refueling operations. To preclude damage to the receptacle, the closed circuit nozzle will be used if possible when refueling. If, however, the receptacle has been previously damaged and leakage occurs, the following must be observed:
Closed circuit refueling operations with a leaking receptacle shall be discontinued. Gravity refueling method shall be used until the receptacle can be replaced or repaired.

(1) Ground the helicopter at the receptacle located adjacent to the filler cap on the helicopter to the filler-nozzle and remove filler cap.

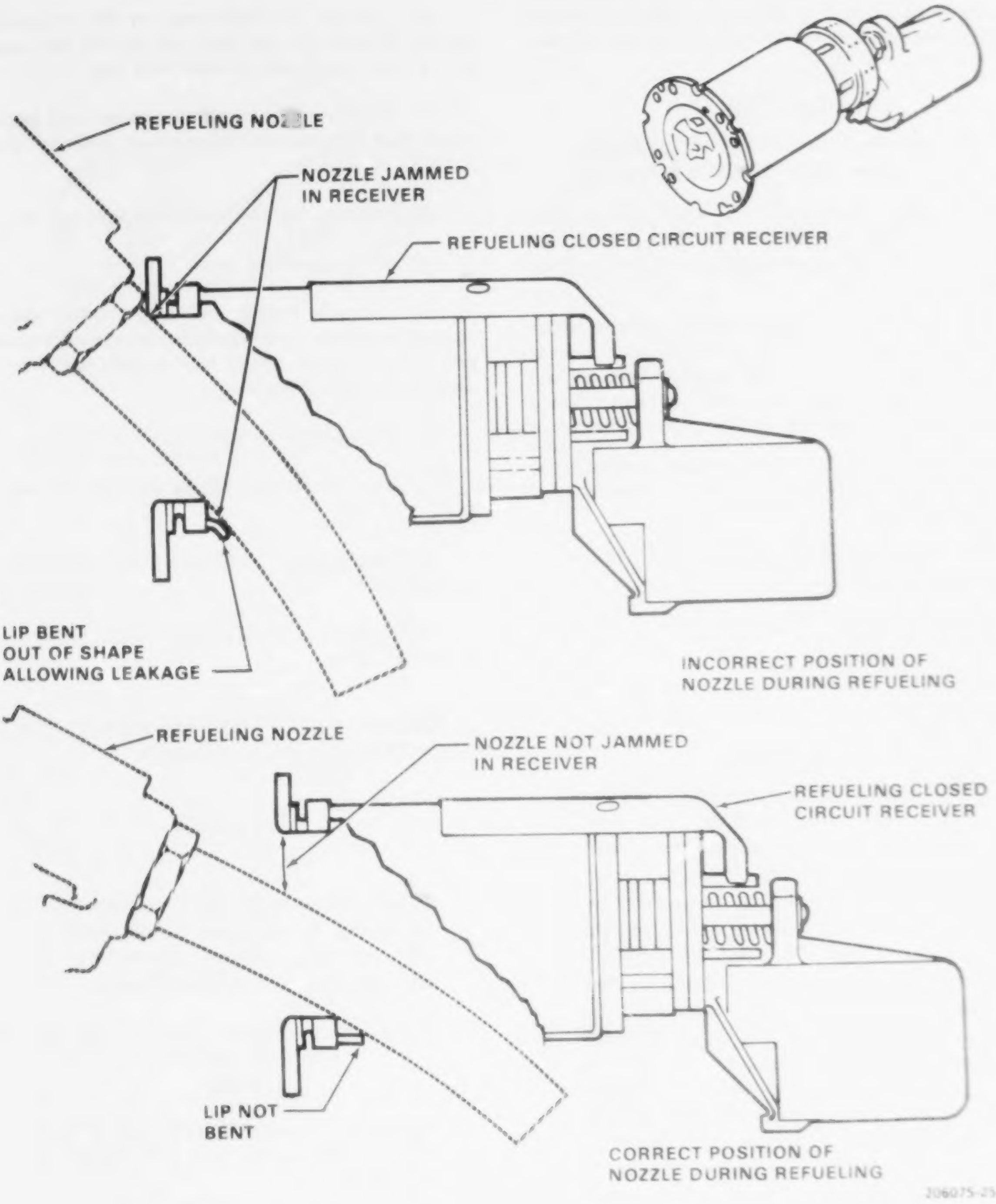

REFUELING NOZZLE
NOZZLE JAMMED IN RECEIVER
REFUELING CLOSED CIRCUIT RECEIVER
LIP BENT OUT OF SHAPE ALLOWING LEAKAGE
INCORRECT POSITION OF NOZZLE DURING REFUELING
REFUELING NOZZLE
NOZZLE NOT JAMMED IN RECEIVER
REFUELING CLOSED CIRCUIT RECEIVER
LIP NOT BENT
CORRECT POSITION OF NOZZLE DURING REFUELING
206075-253

Figure 2-22. Gravity Refueling With Closed Circuit Receiver

(2) Ensure that gravity refueling port is closed. If not, rotate inner sleeve counterclockwise until gravity refueling port is closed and flange of sleeve is in contact with rivet at base of receiving cylinder. Refer to figure 2-23.

CAUTION

Ensure that servicing unit pressure is not above 125 PSI while refueling.

(3) Insert fueling nozzle into receiver and actuate automatic nozzle lever to ON or FLOW position. Pin at base of nozzle will momentarily indicate when fuel flow stops.

(4) Fuel flow will automatically shut off when normal fuel level is reached. Just prior to normal shut off, fuel flow may cycle several times as fuel level is reached. Gage on servicing unit will indicate when flow is stopped.

(5) When fuel flow has stopped, actuate lever on nozzle to OFF, disconnect nozzle from receiver and replace filler cap.

(6) Disconnect fuel nozzle ground and rewind hose assembly.

(7) Disconnect servicing unit ground at helicopter.

(8) Disconnect servicing unit ground at grounding stake.

CAUTION

If helicopter is equipped with closed circuit refueling system and fuel servicing unit is not equipped with related nozzle for closed circuit refueling, a gravity system may be used providing the servicing nozzle does not exceed 1.75 inches outside diameter. To refuel utilizing the gravity nozzle, it is necessary to position the inner sleeve of receiver until slot is lined up with fuel port in bottom of receiver. Position nozzle into port in order to by-pass closed circuit valve. Damage could result to the closed circuit refueling system if caution is not used to prevent damage to inner sleeve of receiver at fuel port through improper use of nozzle.

d. Gravity Refueling.

(1) Ground the helicopter at the receptacle located adjacent to the filler cap on the helicopter to the filler-nozzle and remove filler cap.

(2) Rotate inner sleeve clockwise until sleeve clears port in bottom of fuel receiver. Refer to figure 2-23.

(3) Position nozzle into port of fuel receiver.

(4) Fill to specified level.

(5) Remove nozzle and rotate inner sleeve counterclockwise until gravity refueling port is closed and flange of inner sleeve is in contact with rivet at base of receiver cylinder.

(6) Reinstall filler cap.

(7) Disconnect fuel nozzle ground and rewind hose.

(8) Disconnect servicing unit ground at helicopter.

(9) Disconnect servicing unit ground at grounding stake.

2-78. FUEL SYSTEM SERVICING. (RAPID (HOT) REFUELING).

WARNING

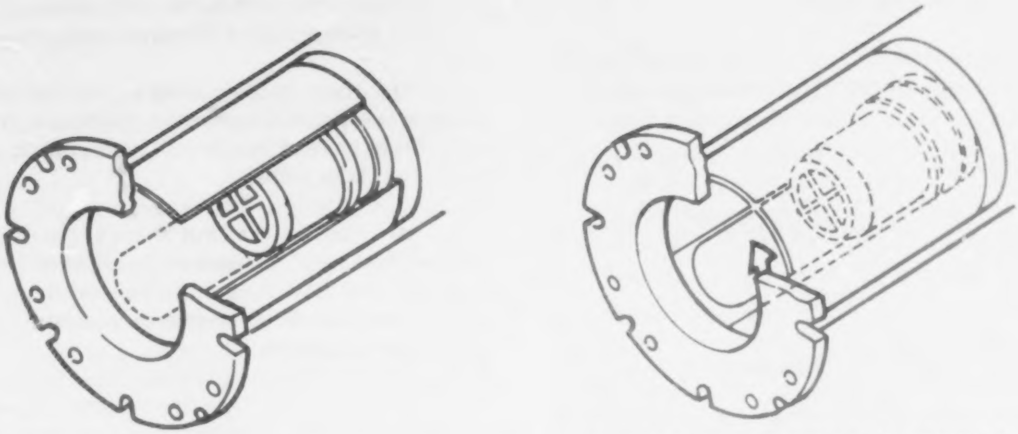
When it is determined that rapid (hot) refueling is required (prescribed in FM 10-68), proper grounding of aircraft must be accomplished.

a. Precautions.

NOTE

Servicing personnel shall comply with all safety precautions and procedures in FM 10-68.

(1) Ground the helicopter at the receptacle located adjacent to the filler cap on the helicopter to the filler-nozzle before removing filler cap.

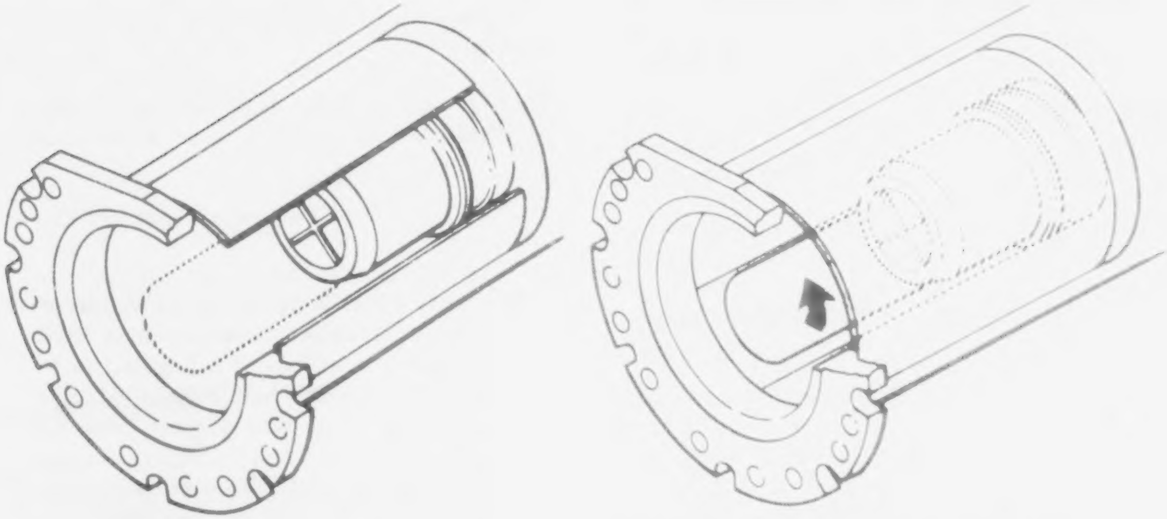


SLEEVE POSITION WHEN USING CLOSED CIRCUIT REFUELING SYSTEM

A

SLEEVE POSITION WHEN USING GRAVITY REFUELING SYSTEM

A



SLEEVE POSITION WHEN USING CLOSED CIRCUIT REFUELING SYSTEM

C

SLEEVE POSITION WHEN USING GRAVITY REFUELING SYSTEM

C

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Figure 2-23. Refueling Receptacle

(2) Servicing unit shall be grounded (servicing unit to ground and servicing unit to helicopter). The helicopter should be grounded to the same ground point as is the servicing unit.

(3) After completion of servicing, remove nozzle, reinstall cap, and disconnect all grounds from helicopter.

b. **Servicing.**

(1) Fill tank cells with specified fuel. Refer to table 2-1.

(2) Refer to table 2-1 for fuel tank capacity.

c. **Before Rapid (Hot) Refueling:**

WARNING

Only emergency radio transmission should be made during rapid refueling. In case of aircraft fire, observe fire emergency procedures in Chapter 9. Do not attempt to fly the aircraft.

(1) Minimum crew will remain at the controls.

(2) Throttle — Idle.

(3) Force Trim — ON or controls frictioned.

(4) Passengers shall depart the aircraft and remain clear of the helicopter.

(5) No smoking allowed during refueling operations.

(6) A crew member, if available, should observe the refueling operation (performed by authorized refueling personnel) and stand fire guard as required.

d. **During Rapid (Hot) Refueling.**

(1) **Closed Circuit Refueling.**

(a) Ground the helicopter at the receptacle located adjacent to the filler cap on the helicopter to the filler-nozzle and remove filler cap.

(b) Ensure that gravity refueling port is closed. If not, rotate inner sleeve counterclockwise until gravity refueling port is closed and flange of sleeve is in contact with rivet at base of receiver cylinder. Refer to figure 2-23.

CAUTION

Ensure that servicing unit pressure is not above 125 PSI while refueling.

(c) Insert fueling nozzle into receiver and actuate automatic nozzle lever to ON or FLOW position. Pin at base of nozzle will momentarily indicate when fuel flow stops.

(d) Fuel flow will automatically shut off when normal fuel level is reached. Just prior to normal shut off, fuel flow may cycle several times as fuel level is reached. Gage on servicing unit will indicate when flow is stopped.

(e) When fuel flow has stopped, actuate lever on nozzle to OFF, disconnect nozzle from receiver and replace filler cap.

(f) Disconnect fuel nozzle ground and rewind hose assembly.

(g) Disconnect servicing unit ground at helicopter.

(h) Disconnect servicing unit ground at grounding stake.

CAUTION

If helicopter is equipped with closed circuit refueling system and fuel servicing unit is not equipped with related nozzle for closed circuit refueling, a gravity system may be used providing the servicing nozzle does not exceed 1.75 inches outside diameter. To refuel utilizing the gravity nozzle, it is necessary to position the inner sleeve of receiver until slot is lined up with fuel port in bottom of receiver. Position nozzle into port in order by bypass closed circuit valve. Damage could result to the closed circuit refueling system if caution is not used to prevent damage to inner sleeve of receiver at fuel port through improper use of nozzle.

(2) **Gravity Refueling.**

(a) Ground the helicopter at the receptacle located adjacent to the filler cap on the helicopter to the filler-nozzle and remove filler cap.

(b) Rotate inner sleeve clockwise until sleeve clears port in bottom of fuel receiver. Refer to figure 2-23.

(c) Position nozzle into port of fuel receiver.

(d) Fill to specified level.

(e) Remove nozzle and rotate inner sleeve counterclockwise until gravity refueling port is closed and flange of inner sleeve is in contact with rivet at base of receiver cylinder.

(f) Reinstall Filler Cap.

(g) Disconnect fuel nozzle ground and rewind hose.

(h) Disconnect servicing unit ground at helicopter.

(i) Disconnect servicing unit ground at grounding stake.

e. **After Rapid Refueling.**

(1) The pilot shall be advised by the refueling crew that fuel cap(s) are secure and ground cable have been removed.

(2) Crew members and passengers can enter aircraft.

f. **Defueling and Draining.**

(1) Remove fuel cap; rotate inner sleeve clockwise until end of sleeve clears port in bottom of fuel receiver.

(2) Insert a suction pickup from a defueler vehicle into the fuel filler opening and remove all possible fuel.

(3) To complete defueling, drain remaining fuel into a suitable container by opening fuel cell sump drain.

2-79. ENGINE OIL SYSTEM SERVICING.

CAUTION

An engine high oil level coupled with a transmission low oil level condition indicates a possible failure of the engine gearbox seal(s) which is allowing oil to be transmitted from the transmission through the free-wheeling unit into the engine.

Engine oil tank is located aft of the engine and oil cooler fan. Oil level is checked by a "trapped ball" sight gage on the tank (figure 2-20 and figure 2-21). Ball must be visible for safe oil level. Refer to table 2-1 for authorized oil.

2-80. TRANSMISSION AND GEARBOX OIL SYSTEM SERVICING.

a. **Transmission.** A sight glass located on the transmission housing (figure 2-20 and figure 2-21) is used to check the oil level in the transmission. The oil level must be visible in sight glass. If oil is visible, additional oil is not required. If oil is not visible in sight glass, add oil to the center dot only. Refer to table 2-1 for authorized oil.

b. **Gearbox.** A sight glass is provided for ease in checking oil level. Refer to table 2-1 for authorized oil. Fill to 1/8 inch above line with standard skid gear. Fill to the line with high skid gear. Fill to the line with float equipped helicopter.

2-81. HYDRAULIC SYSTEM SERVICING.

The hydraulic reservoir (figure 2-20 and figure 2-21) is located on the forward side of the transmission. A sight glass with ball float or line level is provided to determine low quantity of fluid in the reservoir. Fill to overflow lip in reservoir. Refer to table 2-1 for authorized fluid.

2-82. BLADE GRIPS AND PILLOW BLOCKS SERVICING.

a. **Oil Lubricated Hub.** Blade grips and pillow blocks on the main rotor hub are lubricated with oil from reservoirs. Oil level can be checked through transparent covers and sight glasses. Inspect sight glass for oil contamination. When water is present, the oil has a dirty milky appearance. Fill blade grip and pillow block reservoirs to 1/2 full level on sight glass. Refer to table 2-1 for capacities and authorized fluids.

b. **Grease Lubricated Hub.** Blade grips and pillow blocks on the main rotor hub are lubricated with grease through lubrication fittings. The grips have a relief valve located on each pitch horn.

2-83. GROUND HANDLING.

Towing. Tow rings are provided on forward inboard portion of each landing gear skid (figure 2-24) for attachment of a standard aircraft tow bar. Helicopter is towed on ground handling wheel assemblies mounted on the landing skids.

2-84. PARKING.

a. Retract the ground handling wheels and allow the helicopter to rest on the skid type landing gear.

b. Install main rotor blade tie-down (figure 2-24).

c. Install engine air inlet shield assemblies in engine inlets and covers on engine exhausts.

2-85. COVERS.

a. **Engine Inlet and Pitot Tube.** An engine inlet and pitot cover (figure 2-24) is provided to prevent entrance of dust etc., into the engine inlet and pitot system when helicopter is parked. When stowed in helicopter, stow engine inlet shields and pitot covers securely in helicopter cabin only.

b. **Engine Exhaust.** Individual covers (figure 2-24) are provided for the exhaust stacks to prevent entrance of foreign objects into the engine exhaust when helicopter is parked. When stowed in helicopter, stow engine exhaust covers securely in helicopter cabin only.

c. **Main Rotor Tie-Down.**

NOTE

Ensure that strap side of main rotor tie-down boot is on top side of blade and drain hole is positioned at bottom of blade.

A rotor tie-down (figure 2-24) is provided for use in mooring the aft main rotor blade. The tie-down prevents the rotor from see-sawing when the helicopter is parked. When stowed in helicopter, stow rotor tie-down securely in helicopter cabin only.

2-86. MOORING.

CAUTION

Structural damage can occur from flying objects during high wind conditions. Helicopter should be hangared or evacuated to a safe weather area when wind conditions above 50 knots are expected.

a. If a paved ramp with suitable tie-down rings is available, park helicopter on skid landing gear headed in direction from which highest forecast winds are expected. Secure helicopter to ramp tie-downs at helicopter jacking tie-down fittings (figure 2-24). Use of a clevis at each of the tie-down fittings will permit use of larger diameter rope.

b. If suitable spaced ramp tie-downs are not available, park the helicopter on an unpaved parking area headed in the direction from which the highest forecast winds are expected and retract ground handling wheels. Use mooring anchors to make "dead man" anchors. Moor helicopter as described in step a.

c. Secure main rotor with tie-down strap.

d. Install covers on pitot tube, engine exhaust, and engine inlets. Alternate method for installation of pitot and engine inlet covers (figure 2-24) in high wind conditions is as follows: Route strap from pitot tube through the lower front edge of pilot door near lower hinge, and then out the top edge of door to engine air inlets. This will help to prevent marring and streaking of windshields.

e. Tighten friction on cyclic and collective controls.

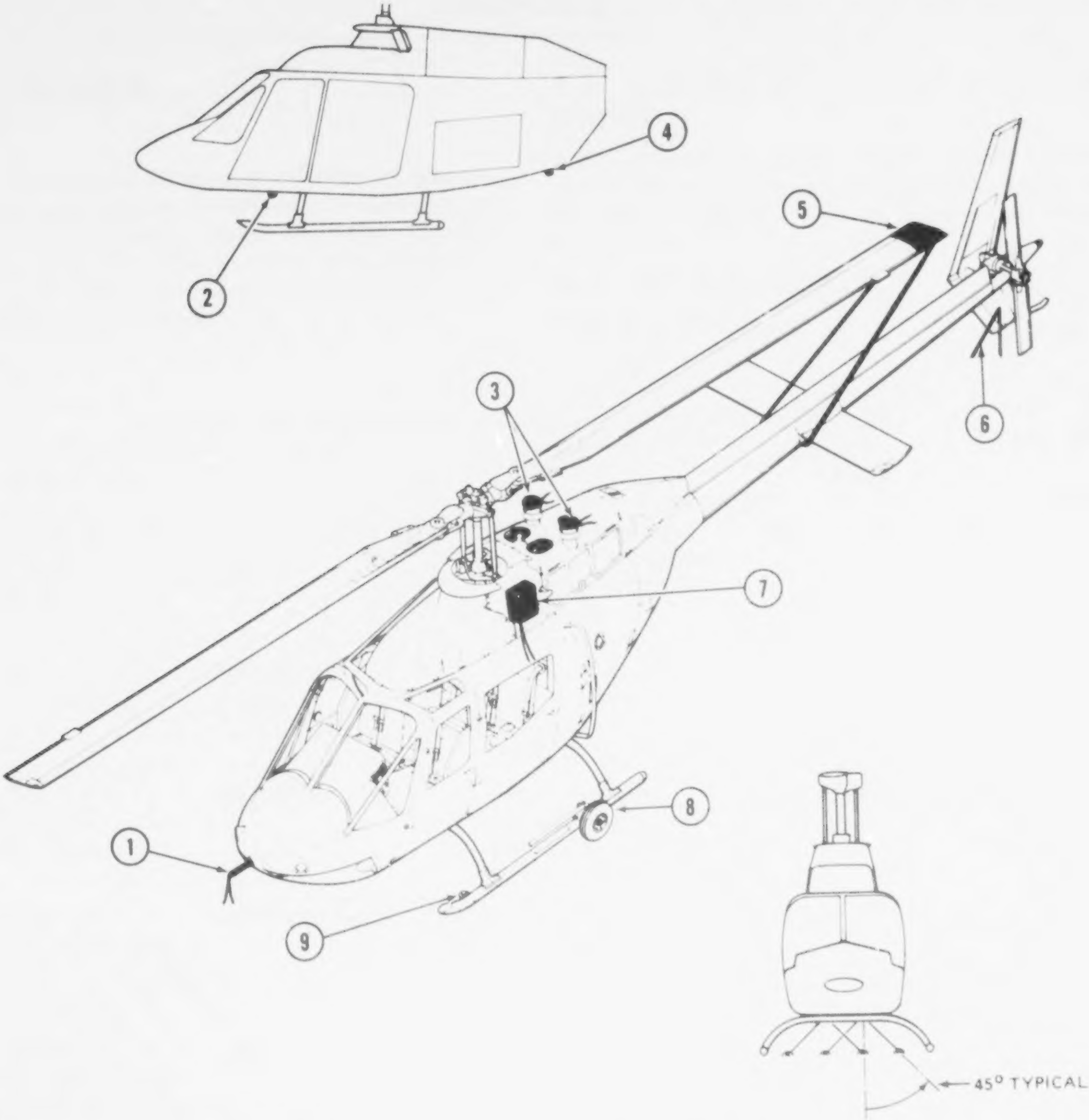
f. Close all windows, doors, and access panels.

g. Fill fuel tank to capacity with prescribed fuel.

h. Secure all ground handling equipment.

2-87. A MOORING — FLOAT EQUIPPED HELICOPTER.

Float equipped helicopters may be moored using same procedures as are used for skid gear equipped helicopters. Surface of mooring area must be smooth and free of any objects which may damage or penetrate floats.



1. Pitot Tube Cover
2. Forward Jacking and Tiedown Fitting
3. Exhaust Covers
4. Aft Jacking and Tiedown Fitting
5. Main Rotor Blade Tiedown
6. Tail Rotor Tiedown
7. Engine Air Inlet Shield
8. Ground Handling Gear
9. Towing Ring

206070-297

Figure 2-24. Ground Handling Equipment, Covers, Rotor Tiedowns, and Mooring Diagram

CHAPTER 3

AVIONICS

3-1. GENERAL.

3-2. This chapter contains all information relevant to the avionics equipment installed in the Army Model OH-58A/C helicopter. Included information consists of description, technical characteristics, capability, location of each major component and operation instructions for the system.

3-3. NOMENCLATURE AND COMMON NAMES.

3-4. Avionics equipment installed in the helicopter, with common names, use, and operational range, is presented in Table 3-1. Antenna locations are shown in figure 3-1.

3-5. POWER SUPPLY.

Refer to figure 2-18.

Table 3-1. Communications and Associated Electronics Equipment

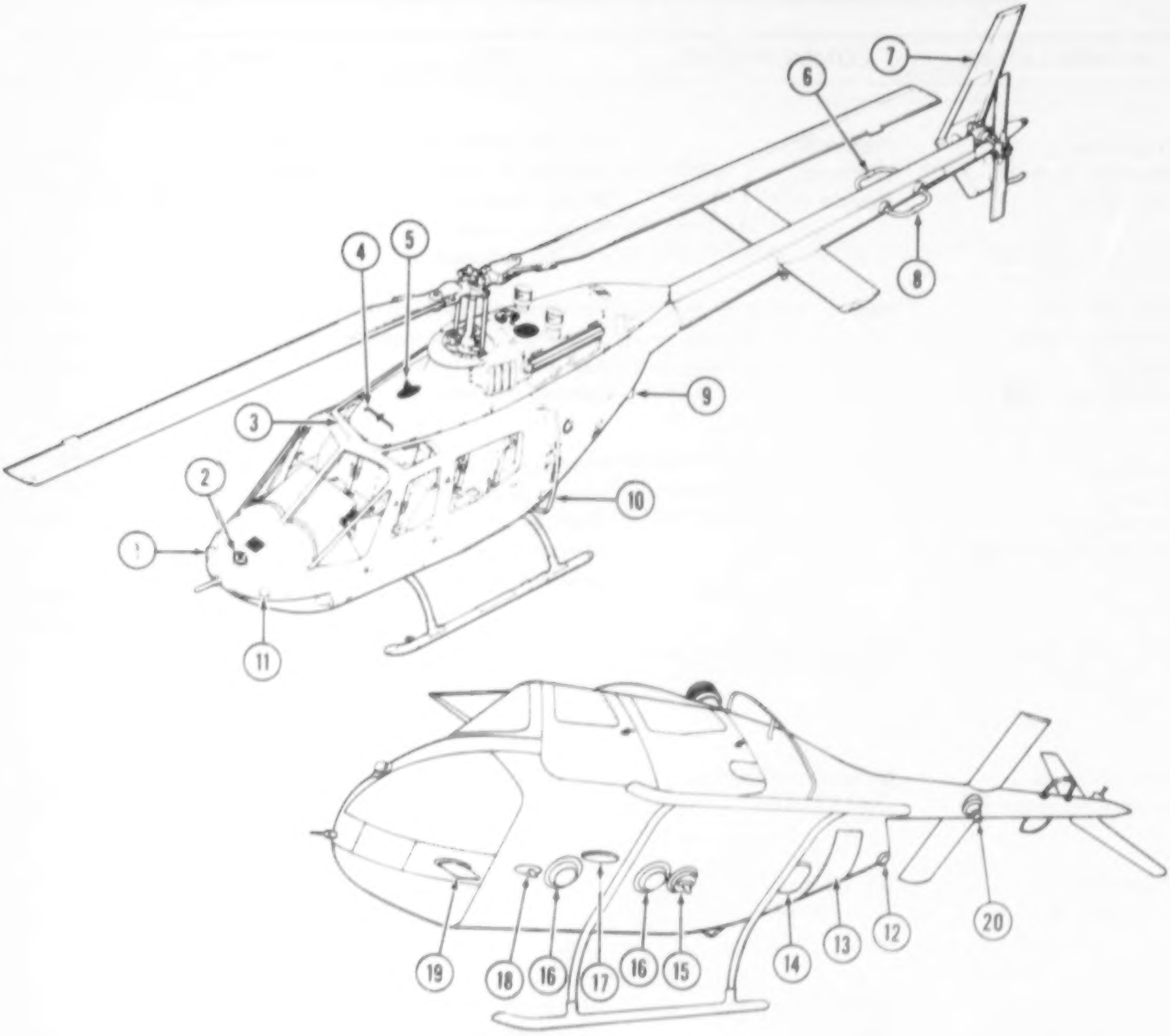
NOMENCLATURE	COMMON NAME	USE	RANGE
Communication System Control C-6533/ARC	Communication Control	Interphone for pilot and crew. Integrates all communication equipment	Stations within helicopter.
Radio Set AN/ARC114FM	FM Radio Set	Two-way Voice Communications in frequency range of 30.00 to 75.95 MHz	Line of sight
Radio Set AN/ARC114A VHF-FM	FM Radio	Two-way Voice Communications in frequency range of 30.00 to 75.95 MHz	Line of sight
Radio Set AN/ARC115VHF-AM	VHF Radio Set	Two-way Voice Communication in the frequency range of 116.00 to 149.975 MHz	Line of sight
Radio Set AN/ARC116UHF-AM (or AN/ARC-164)	UHF Radio Set	Two-way Voice Communications in the frequency range of 225.00 to 399.95 MHz	Line of sight
Direction Finder/Set AN/ARN-89	ADF	Radio Range Navigation and position fixing Automatic direction finding and homing in the frequency range of 100 to 3,000 KHz	150 to 200 miles average depending on terrain interference noise

Table 3-1. Communications and Associated Electronics Equipment (Cont)

NOMENCLATURE	COMMON NAME	USE	RANGE
Radio Set AN/ARC51BX A	UHF Radio Set	Two-way Voice Communications in the frequency range of 225.0 to 399.9 MHz	Line of sight
Voice Security Equipment TSEC/KY-58	Secure-Voice encoder-decoder	In conjunction with FM radio set to provide secure two-way voice communication	
Gyromagnetic Compass Set AN/ASN-43	Gyromagnetic Compass	Navigational Aid provides accurate heading information	
Transponder Set AN/APX-72 A	Transponder Set	Transmit a special coded reply to ground based IFF radar interrogator system	
Radio Set AN/ARN-123(V)1 C	Conus Navigation Receiver	With appropriate instrumentation provides: VHF omni-directional range (VOR), localizer (LOC), glideslope (GS), and marker beacon (MB) position information.	Line of sight
Radar Altimeter AN/APN-209 C	Radar Altimeter	Provides altitude indication above terrain. Permits selected altitude limits and visual warning when altitude is above or below selected limits.	0 to 1500 feet above terrain.
Transponder Set AN/APX-100 C	IFF Transponder Radio	Transmits a special coded reply for radar interrogator systems.	Line of sight

Table 3-1. Communications and Associated Electronics Equipment (Cont)

NOMENCLATURE	COMMON NAME	USE	RANGE
Proximity Warning System YG-1054	Proximity Warning Device	Provides proximity warning in high density aircraft areas to avoid mid-air collision.	1000 Ft. 3000 Ft. 5000 Ft.
Indicator, Heading-Radio Bearing ID-1351C/A C	HBI	Provides magnetic heading, VOR or ADF bearing, and homing information.	
Indicator, Course Deviation ID-1347C/ARN C	CDI	Provides VOR course deviation, localizer and glideslope signal information.	
Command Radio Set Control C-6287	Control/Indicator C-6287		
Secure-Voice Control Indicator A	Control/Indicator C-8157/ARC		
Computer Kit 1A/TSEC A	IFF Computer		
Radar Warning AN/APR-39	Radar Warning Set	Visual and Audible Warning when a high radar threat environment is encountered.	Line of Sight



1. Antenna, Radar Warning — Fwd Right Side
2. Antenna, Proximity Warning — Fwd
3. Antenna, FM No. 2
4. Antenna, Glidescope C
5. Antenna, Top Transponder C
6. Antenna, VOR — Right Side C
7. Antenna, VHF/FM
8. Antenna, VOR — Left Side C
9. Antenna, Radar Warning — Aft Side Shown,
   Aft Right Side Opposite
   Antenna, FM Homing — Left Side Shown
   Right Side Opposite
11. Antenna, Radar Warning — Fwd Left Side
12. Antenna, Proximity Warning — Aft
13. Antenna, ADF Sense
14. Antenna, ADF Loop
15. Antenna, Radar Warning — Blade
16. Antenna, Radar Altimeter C
17. Antenna, Marker Beacon C
18. Antenna, Bottom Transponder A
19. Antenna, UHF
20. Antenna, Bottom Transponder C

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Figure 3-1. Antenna Locations

SECTION I. COMMUNICATIONS

3-6. COMMUNICATIONS SYSTEM CONTROL, C-6533/ARC.

3-7. DESCRIPTION — COMMUNICATIONS SYSTEM CONTROL.

The communications system control, C-6533/ARC (figure 3-2) provides an intercommunications capability and control of radio communications. Two of the control panels are installed on the instrument panel, one each for the pilot and another crew member. Another control panel is installed on the right side overhead in the passenger compartment. The control panels may be used in any one of three different modes as determined by the setting of switches and controls on the panel.

3-8. CONTROLS AND FUNCTIONS — COMMUNICATIONS SYSTEM CONTROL.

Refer to figure 3-2.

3-9. OPERATING PROCEDURES — COMMUNICATIONS SYSTEM CONTROL.

a. **Modes of Operation.** The three modes of operation are two-way radio communication, radio receiver monitoring, and intercommunications within the helicopter.

b. **Operation.**

(1) Receiver switches — As desired.

(2) VOLume control — Adjust.

(3) HOT MIKE switch — As desired.

(4) Transmit-Interphone Selector — As required.

3-10. VHF/FM RADIO SET.

3-11. DESCRIPTION — VHF/FM RADIO SET.

The AN/ARC-114 and AN/ARC-114A radio sets provide two way frequency modulated (FM) narrow band voice communications and homing capability (Number one unit only) within frequency range of 30.00 to 75.95 MHz on 920 channels for a 50-mile distance as limited by line of sight. A guard receiver incorporated in the set is fixed tuned to 40.50 MHz. Retransmission of voice, CW or X-mode communications is possible when a second set is installed in the helicopter. The radio sets are marked VHF/FM COMM and are installed in the center console. Antenna location is located as shown in figure 3-1.

3-12. CONTROLS AND FUNCTIONS — FM RADIO SET.

Refer to figure 3-3.

NOTE

When transmitting and/or receiving on VHF (FM) in secure mode, do not key or transmit simultaneously on any other transmitter.

3-13. OPERATING PROCEDURES — FM RADIO SET.

a. **Transmit/Receive.**

(1) Function selector — As desired.

(2) Frequency — Select.

(3) RCVR TEST — Press to test.

(4) AUDIO — Adjust.

(5) Transmit.

(a) Transmit-Interphone selector — Number 1 position (Number 5 position for second FM set).

(b) RADIO transmit switch — Press.

b. **Homing.**

(1) Function selector — HOMING.

(2) AUDIO — Adjust.

(3) Observe homing indications on the radio bearing heading indicator.

c. **Retransmission.**

NOTE

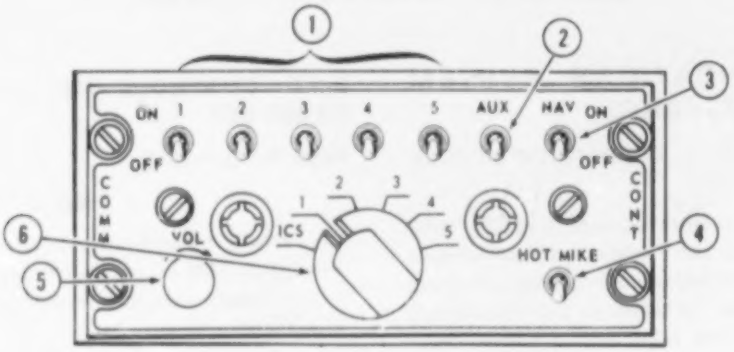
Crew transmission may also be made while in RETRAN mode.

(1) Frequencies — Select (Both FM sets).

NOTE

Frequencies must have a minimum of five MHz difference, such as 30.00 MHz and 35.00 MHz.

(2) Communications — Establish with each facility by selecting number 1 position and then number 5 position on the Transmit-Interphone selector.



CONTROL/INDICATOR	FUNCTION
1. Receiver Switches	Connect (ON) or disconnect (OFF) communications receivers from the headsets.
1 – FM	
2 – UHF	
3 – VHF	
4 – Not used	
5 – FM (When second FM set is installed)	
2. AUX Receiver Switch	Not Used **A** . Connects (ON), or disconnects (OFF), VOR set receiver ARN-123(V)1 from the headset **C** .
3. NAV Receiver Switch	Connects (ON) or disconnects (OFF) navigation receiver ARN-89 from the headset.
4. HOT MIKE Switch	Permits hand-free intercommunications regardless of the position of the transmit-interphone selector. Permits hand-free intercommunications with transmit-interphone selector in the ICS position **C** .
5. VOL Control	Adjust volume from receivers. Adjust intercommunications volume.
6. Transmit-Interphone Selector	Selects transmitter to be keyed and connects microphone to transmitter.
1 – FM	
2 – UHF	
3 – VHF	
4 – Not used	
5 – FM (When second FM set is installed)	
ICS	Connects the microphone to the intercommunications system only, disconnecting microphone from transmitters.

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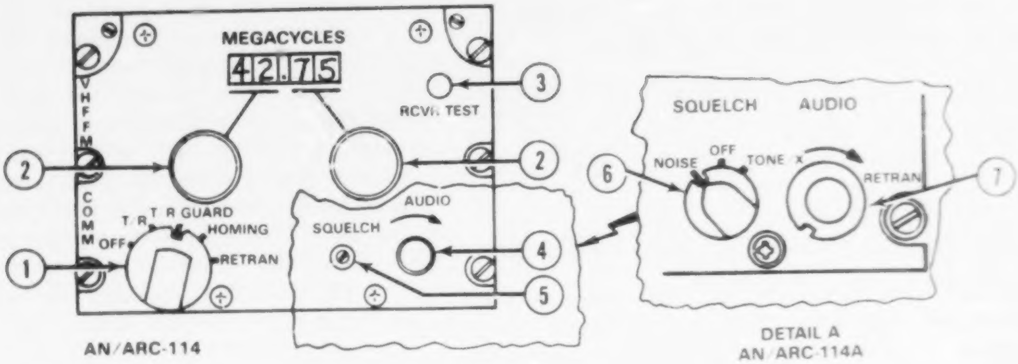
Figure 3-2. Communication System Control Panel C-6533/ARC


MEGACYCLES
42.75
VHF FM
COMM
RCVR TEST
T/R
T/R GUARD
OFF
HOMING
RETRAN
AUDIO
SQUELCH
1
2
3
4
5
AN/ARC-114
SQUELCH
AUDIO
NOISE
OFF
TONE X
RETRAN
6
7
DETAIL A
AN/ARC-114A

CONTROL/INDICATOR	FUNCTION
1. Function Selector	
OFF	Power off.
T/R	Receiver — On; Transmitter — Standby.
T/R GUARD	Receiver — On; Transmitter — Standby; Guard Receiver — On NOTE: Reception on guard frequency is unaffected by frequencies selected for normal communications.
HOMING	Activates the homing mode and display on the radio bearing heading indicator. May be used also for normal voice communications.
RETRAN	Activates the retransmission mode when second FM set is installed in the aircraft. May be used also for normal voice communications.
2. Frequency Selectors	
Left Selector	Selects first two digits of desired frequency.
Right Selector	Selects third and fourth digits of desired frequency.
3. RCVR TEST	When pressed, audible signal indicates proper receiver performance.
4. AUDIO	Adjusts receiver volume.
5. SQUELCH	Squelch control adjusted by maintenance personnel only.
6. SQUELCH	
OFF	Disables squelch.
NOISE	Activates noise squelch.
TONE/X	Activates tone squelch for secure voice mode.
7. AUDIO	Adjusts receiver volume. Control is set to white RETRAN segment for proper audio output during retransmission operations.

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Figure 3-3. AN/ARC-114 and AN/ARC-114A Control Panel

(3) Function selectors — RETRAN (Both FM sets).

(4) Receiver switches — Number 1 and number 5 positions as desired for monitoring.

d. **Stopping Procedures.** Function Selector — OFF.

3-14. VHF/AM RADIO SET — AN/ARC-115.

3-15. DESCRIPTION — VHF/AM RADIO SET.

The ARC-115 (figure 3-4) provides two-way VHF amplitude modulated (AM) narrow band voice communications within the frequency range of 116.00 to 149.75 MHz on 1360 channels for a distance range of approximately 50 miles line of sight. A guard receiver is incorporated in the set and is fixed tuned to 121.50 MHz. The radio set is marked VHF AM COMM and is mounted on the left side of the instrument panel. Antenna installation is shown in figure 3-1.

3-16. CONTROLS AND FUNCTIONS — VHF/AM RADIO SET.

Refer to figure 3-4.

3-17. OPERATING PROCEDURES — VHF/AM RADIO SET.

a. **Transmit/Receive.**

(1) Function selector — As desired.

(2) Frequency — Select.

(3) RCVR TEST — Press to test.

(4) AUDIO — Adjust.

(5) Transmit.

(a) Transmit-interphone selector — Number 5 position **A**. Number 3 position **C**.

(b) RADIO transmit switch — PRESS.

b. **Stopping Procedure.** Function Selector — OFF.

3-18. UHF/AM RADIO SET.

3-19. DESCRIPTION. The UHF-AM radio set AN/ARC-116 (or AN/ARC-164) (figures 3-5 and 3-6) provides two-way UHF amplitude modulated (AM) narrow band voice communications within the frequency range of 225.00 to 399.95 MHz on 3500 channels for a distance of approximately 50 miles as limited by conditions. A guard receiver is incorporated in the set and is fixed tuned to 243.00 MHz. Both receivers are disabled during transmitter operation. The radio set is marked UHF AM COMM and is mounted in the bottom center section of the instrument panel. The UHF radio transmitter and main receiver operate on the same frequency and are simultaneously tuned by frequency selector knobs on the panel. The set utilizes position number 2 of the C-6533/ARC intercommunications control panel. The AN/ARC-164 provides for twenty preset channels in addition to the manual selection of channels. Preset selection is accomplished by positioning the mode switch to PRESET and function selector to MAIN. Select the desired frequency with the frequency selector knobs and press the PRESET pushbutton located under the access cover upper left portion of radio.

3-20. CONTROLS AND FUNCTIONS — UHF/AM RADIO SET.

Refer to figure 3-5 and 3-6.

3-21. OPERATING PROCEDURES — UHF/AM RADIO SET.

NOTE

Determined by radio set serial number the following channels of the AN/ARC-116 Radio Set are degraded and unuseable as communication frequencies.

1. 230.20 MHz
2. 235.15
3. 243.40
4. 250.00
5. 274.65
6. 286.80
7. 290.00
8. 290.30
9. 300.00
10. 320.00
11. 320.05
12. 335.15
13. 336.80
14. 350.00
15. 360.00
16. 366.20
17. 370.05
18. 385.15
19. 386.80
20. 390.00

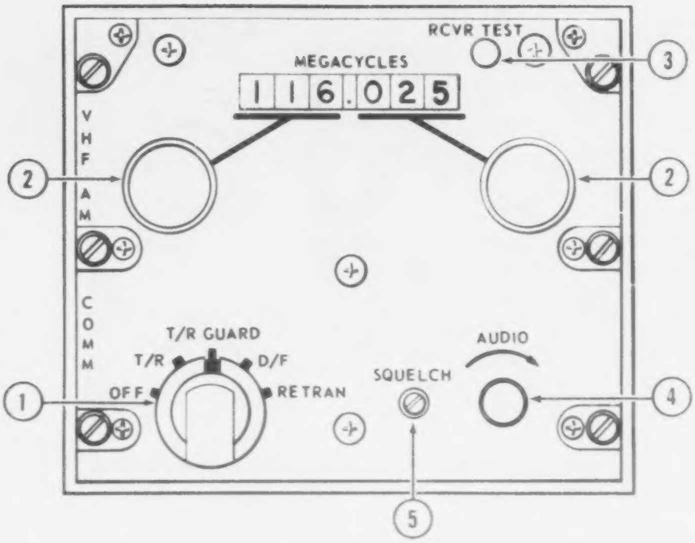
AN/ARC-116 Radio Set

Serial Number 137 and subsequent

1. 274.65 MHz
2. 300.00
3. 366.20

a. **Transmit/Receive.**

(1) Function selector — As desired.


RCVR TEST
MEGACYCLES
116.025
VHF AM
COMM
T/R GUARD
T/R
D/F
OFF
RETRAN
SQUELCH
AUDIO
1
2
2
3
4
5

CONTROL/INDICATOR	FUNCTION
1. Function Selector	
OFF	Power off.
T/R	Receiver – On; Transmitter – Standby.
T/R GUARD	Receiver – On; Transmitter – Standby; Guard Receiver – On. NOTE: Reception on guard frequency is unaffacted by frequencies selected for normal communications.
D/F	Not used.
RETRAN	Not used.
2. Frequency Selectors	
Left Selector	Selects first three digits of desired frequency.
Right Selector	Selects fourth, fifth and sixth digits of desired frequency.
3. RCVR TEST	When pressed, audible signal indicates proper receiver performance.
4. AUDIO	Adjusts receiver volume.
5. SQUELCH	Squelch control adjusted by maintenance personnel only.

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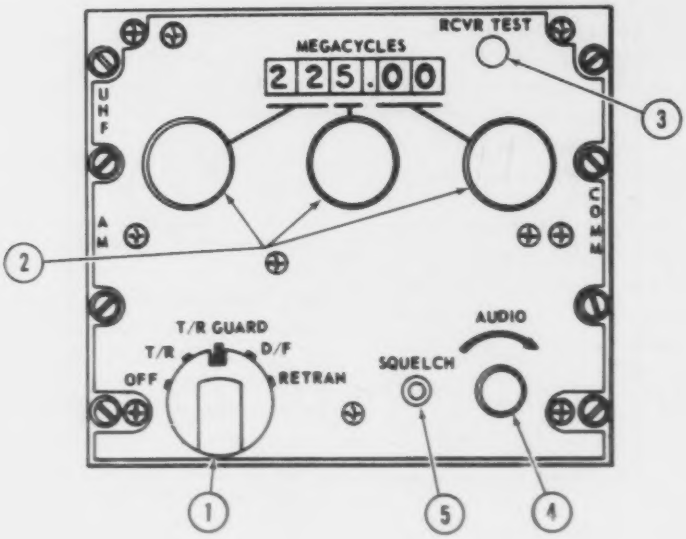
Figure 3-4. AN/ARC-115 Control Panel


MEGACYCLES
2 2 5 . 0 0
RCVR TEST
U H F
A M
C O M M
T/R GUARD
T/R
D/F
OFF
RETRAN
SQUELCH
AUDIO
1
2
3
4
5

CONTROL/INDICATOR	FUNCTION
1. Function Selector	
OFF	Power off.
T/R	Receiver – On: Transmitter – Standby.
T/R GUARD	Receiver – On; Transmitter – Standby; Guard Receiver – On. NOTE: Reception on guard frequency is unaffected by frequencies selected for normal communications.
D/F	Not used.
RETRAN	Not used.
2. Frequency Selectors	
Left Selector	Selects first two digits of desired frequency.
Center Selector	Selects third digit (1 MHz steps) of desired frequency.
Right Selector	Selects last two digits of desired frequency.
3. RCVR TEST	When pressed, audible signal indicates proper receiver performance.
4. AUDIO	Adjusts receiver volume.
5. SQUELCH	Squelch control adjusted by maintenance personnel only.

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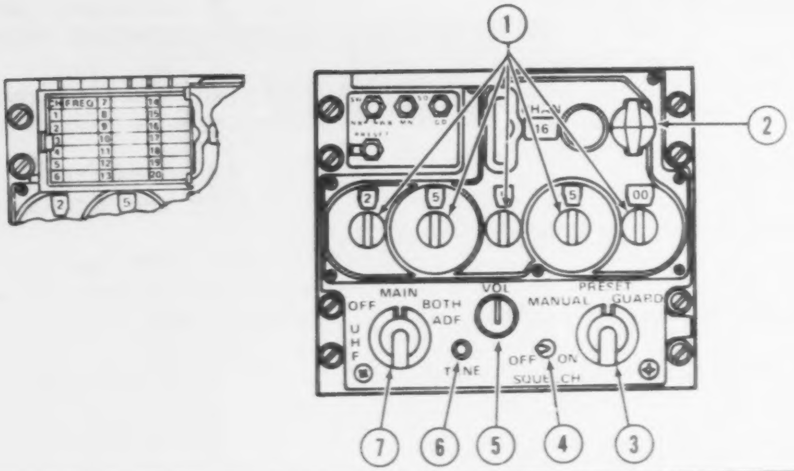
Figure 3-5. AN/ARC-116 Control Panel


①
②
CH FREQ
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
2
5
CHAN
16
2
5
1
5
00
OFF
MAIN
BOTH
ADF
UHF
TONE
VOL
OFF
ON
SQUELCH
MANUAL
PRESET
GUARD
⑦
⑥
⑤
④
③

CONTROL/INDICATOR	FUNCTION
1. **Frequency Selectors**	
Hundreds	Selects first digit of desired frequency.
Tens	Selects second digit of desired frequency.
Units	Selects third digit (1 MHz) of desired frequency.
Tenths	Selects fourth digit of desired frequency.
Hundredths	Selects last two digits of desired frequency.
2. CHAN	Selects preset channels.
3. Mode Selector	
MANUAL	Frequency selected with frequency selector knobs.
PRESET	Selects preset channel as desired by CHAN selector.
GUARD	Frequency is automatically positioned to guard channel (243.00 MHz).
4. SQUELCH	
OFF	Received unsquelched.
ON	Received squelch operating.
5. VOL Control	Adjust receiver audio volume.
6. TONE	When pressed, audible tone indicates proper receiver/transmitter performance (transmits on selected frequency).
7. Function Selector	
OFF	Power off.
MAIN	Receiver — On; Transmitter — Standby.
BOTH	Receiver — On; Transmitter — Standby. Guard Receiver — On.
ADF	Not used.

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Figure 3-6. UHF/AM Radio Set AN/ARC-164

(2) Frequency — Select.

(3) RCVR TEST — Press to test.

(4) AUDIO — Adjust.

(5) Transmit.

(a) Transmit — Interphone selector — Number 2 position.

(b) RADIO transmit switch — PRESS.

b. **Stopping Procedures.** Function Selector — OFF.

3-22. OPERATING PROCEDURES — AN/ARC-164.

a. **Transmit/receive.**

(1) Function selector — As desired.

(2) Frequency — Select.

(3) TONE — Press to test.

(4) VOL — Adjust.

(5) Transmit.

(a) Transmit — Interphone selector — Number 2 position.

(b) RADIO transmit switch — PRESS.

b. **Stopping Procedure.** Function Selector — OFF.

3-23. A UHF/AM COMMAND RADIO SET — AN/ARC-51BX.

3-24. A DESCRIPTION — UHF/AM COMMAND RADIO SET.

The ARC-51BX radio set operates within the ultra high frequency (UHF) bank of 225.0 to 339.9 megahertz (MHz). The set tunes in 0.05 MHz increments and provides 3500 channels. This radio also permits selection of 20 preset channels and permits monitoring of the guard channel and provides two-way radio communication. Transmission and reception are conducted on the same frequency with the use of a common antenna.

3-25. A CONTROLS AND FUNCTIONS — UHF/AM COMMAND RADIO SET.

Control panel C-6287 (figure 3-7) is marked UHF and is mounted in the instrument panel.

3-26. A OPERATING PROCEDURES — UHF/AM COMMAND RADIO SET.

a. **ARC-51BX Operation.** The operating procedures for the command set is outlined in the following steps:

(1) BAT switch — BAT (OFF for APU).

(2) UHF and INT circuit breakers – IN.

(3) Function select switch — T/R(T/R+G) as desired.

(4) Mode selector switch — PRESET CHAN. Allow five minute warmup.

(5) RECEIVERS switch No. 2 — ON.

(6) Channel — Select.

NOTE

An 800 Hz audio tone should be heard during channel changing cycle.

(7) SQ DISABLE switch — ON.

(8) VOLume — Adjust.

(9) Transmit — Interphone No. 2 position selector switch.

(10) Microphone switch — Press.

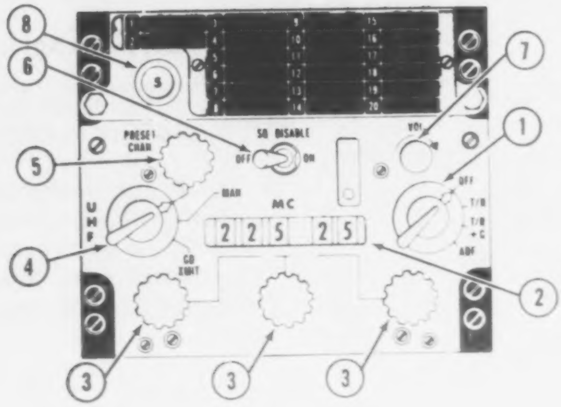
b. **Stopping Procedures.** Function select switch — OFF.

c. **ARC-51BX Guard Frequency Operation.** Operation of the guard frequency may be accomplished by any of the following methods.

(1) Preset guard.

(a) Function select switch — T/R+G.

(b) Mode selector — DF XMIT.



CONTROL/INDICATOR	FUNCTION
1. Function Selector	Applies power to radio and selects type of operation.
OFF Position	Removes operating power from the set.
T/R Position	Transmitter and main receiver on.
T/R + G Position	Transmitter, main receiver and guard receiver on.
ADF Position	Not used
2. Channel Indicator	Indicates the frequency selected by the frequency controls.
3. Frequency Controls	
Left-hand Control	Selects the first two digits of desired frequency.
Center Control	Selects the third digit of desired frequency.
Right-hand Control	Selects the fourth and fifth digits of the desired frequency.
4. Mode Selector	Determines the manner in which the frequencies are selected as follows:
PRESET CHAN Position	Permits selection of one of 20 preset channels by means of preset channel control.
MAN Position	Permits frequency selection by means of frequency controls.
GD XMIT Position	Receiver transmitter automatically tunes to guard channel frequency.
5. PRESET CHAN	Permits selection of any of 20 preset channels.
6. SQ DISABLE Switch	In the ON position squelch is disabled. In the OFF position the squelch is operative.
7. VOL Control	Controls the receiver audio volume.
8. Preset Channel indicator	Indicates the preset channel selected by preset channel control.

Figure 3-7. AN/ARC-51BX Control Panel A

(c) Microphone switch — Press.

(2) Preset

(a) Mode selector — Preset.

(b) Function selector switch — T/R(T/R+G).

(c) Guard Channel — Select.

(d) Microphone switch — Press.

(3) Manual.

(a) Mode selector — Manual.

(b) Function select switch — T/R(T/R+G).

(c) Guard frequency — Select.

(d) Microphone switch — Press.

3-27. VOICE SECURITY EQUIPMENT TSEC/KY-58.

a. **Description.** The voice security equipment is used with the FM Command Radio to provide secure two way communication. The equipment is controlled by the control-indicator (Z-AHP) mounted in the lower console. The POWER switch must be in the ON position, regardless of the mode of operation, whenever the equipment is installed.

b. **Controls and Functions.** Refer to Figure 3-8.

3-28. OPERATING PROCEDURES. Normal operation will exist without the TSEC/KY-58 and the control-indicator (Z-AHP) being installed in the helicopter. Refer to the following procedures to operate the equipment in any particular mode.

3-29. SECURE VOICE PROCEDURES.

NOTE

To talk in secure voice, the KY-58 must be "Loading" with any number of desired variables.

a. Set to MODE switch to OP.

b. Set the FILL switch to the storage register which contains the crypto-net variable (CNV) you desire.

c. Set the POWER switch to ON.

d. Set the PLAIN C/RAD switch to C/RAD.

e. If the signal is to be retransmitted, set the DELAY switch to (ON).

f. At this time a crypto alarm, and background noise, in the aircraft audio intercomsystem should be heard. To clear this alarm, press and release PTT in the aircraft audio/intercom system. Secure voice communication is now possible.

NOTE

When operating in either secure or clear (plain) voice operations, the VOLUME must be adjusted on the aircraft radio and intercom equipment to a comfortable operating level.

3-30. CLEAR VOICE PROCEDURES.

a. Set the PLAIN-C/RAD switch to PLAIN.

b. Operate the equipment.

3-31. ZEROIZING PROCEDURES.

CAUTION

Instructions should originate rom the Net Controller or Commander asto when to zeroize the equipment.

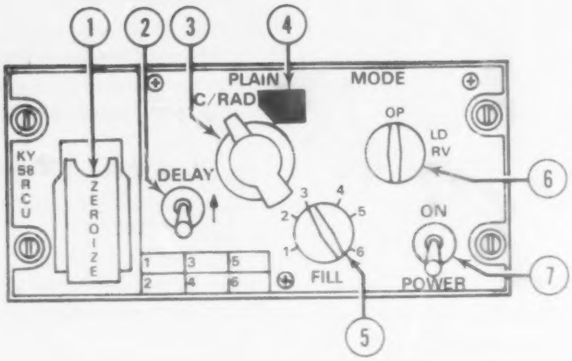
To zeroize the KY-58: (Powernust be on)

a. Lift the red ZEROIZE svitch cover on the RCU.

b. Lift the spring-loaded ZEROIZE switch. This will zeroize positions 1-6.

c. Close the red cover.

The equipment is now zeroized nd secure voice communications are no longer posible.



CONTROL/INDICATOR	FUNCTION
1. **ZEROIZE switch** (two-position momentary toggle under spring loaded cover).	Zeroizes the KY-58; clears any encoding in the system
2. **DELAY switch** two-position toggle	Used when signal is to be retransmitted.
3. **PLAIN-C/RAD** Switch rotary two-position selector switch.	In the PLAIN position, permits normal (unciphered) communications on the associated FM radio set. In the C/RAD position, permits ciphered communications on the associated radio set.
4. **C/RAD2** Switch stop	Location of stop for C/RAD2 on front panel.
5. **FILL switch** six-position rotary switch	Permits pilot to select one of 6 storage registers for filling.
6. **MODE Switch** three position rotary	In the OP position KY-58 normal operating. In the LD position for filling. In the RV position KY-58 in Receive Variable Filled from another external source.
7. **POWER ON switch** two position toggle	Connects power to the associated TSEC/KY-58 cipher equipment in the ON (forward) position, and disconnecis power from the equipment in the OFF (aft) position. Turns on power to TSEC/KY-58.

Figure 3-8. Voice Security Equipment T/SEC KY-58

3-32. AUTOMATIC REMOTE KEYING PROCEDURE.

NOTE

> Automatic Remote Keying (AK) causes an "old" crypto-net variable (CNV) to be replaced by a "new" CNV. Net Controller simply transmits the "new" CNV to your KY-58.

a. The Net Controller will use a secure voice channel, with directions to stand by for an AK transmission. Calls should not be made during this stand by action.

b. Several beeps should now be heard in your headset. This means that the "old" CNV is being replaced by a "new" CNV.

c. Using this "new" CNV, the Net Controller will ask you for a "radio check."

d. After the "radio check" is completed, the Net Controller instructions will be to resume normal communications. No action should be taken until the net controller requests a "radio check."

3-33. MANUAL REMOTE KEYING PROCEDURES. The Net Controller will make contact on a secure voice channel with instructions to stand by for a new crypto-net variable (CNV) by a Manual Remote Keying (MK) action. Upon instructions from the Net Controller:

a. Set the Z-AHP FILL switch to position 6. Notify the Net Controller by radio, and stand by.

b. When notified by the Net Controller, set the Z-AHP MODE switch to RV (receive variable). Notify the Net Controller, and stand by.

c. When notified by the Net Controller, set the Z-AHP FILL switch to any storage position selected to receive the new CNV (may be unused or may contain the variable being replaced). Notify the Net Controller, and stand by.

NOTE

> When performing Step c. the storage position (1 through 6) selected to receive the new CNV may be unused, or it may contain the variable which is being replaced.

d. Upon instructions from the Net Controller:

(1) Listen for a beep on your headset.

(2) Wait two seconds.

(3) Set the RCU MODE switch to OP.

(4) Confirm.

e. If the MK operation was successful, the Net Controller will now contact you via the new CNV.

f. If the MK operation was not successful, the Net Controller will contact you via clear voice (plain) transmission; with instructions to set your Z-AHP FILL selector switch to position 6, and stand by while the MK operation is repeated.

3-34. KY-58 AUDIO TONES. It is important to be familiar with certain KY-58 audio tones. Some tones indicate normal operation, while others indicate equipment malfunction. These tones are:

a. Continuous beeping, with background noise, is cryptoalarm. This occurs when power is first applied to the KY-58, or when the KY-58 is zeroized. This beeping is part of normal KY-58 operation. To clear this tone, press and release the PTT button on the Z-AHQ (after the Z-AHQ LOCAL switch has been pressed). Also the PTT can be pressed in the cockpit.

b. Background noise indicates that the KY-58 is working properly. This noise should occur at TURN ON of the KY-58, and also when the KY-58 is generating a cryptovariable. If the background noise is not heard at TURN ON, the equipment must be checked out by maintenance personnel.

c. Continuous tone, could indicate a "parity alarm." This will occur whenever an empty storage register is selected while holding the PTT button in. This tone can mean any of three conditions:

(1) Selection of an empty storage register.

(2) A "bad" cryptovariable is present.

(3) Equipment failure has occurred. To clear this tone, follow the "Loading Procedures" in TM 11-5810-262-OP. If this tone continues, have the equipment checked out by maintenance personnel.

d. Continuous tone could also indicate a cryptoalarm. If this tone occurs at any time other than in (c) above, equipment failure may have occurred. To clear this tone, repeat the "Loading Procedures" in TM 11-5810-262-OP. If this tone continues, have the equipment checked out by maintenance personnel.

e. Single beep, when RCU is not in TD (Time Delay), can indicate any of three normal conditions:

(1) Each time the PTT button is pressed when the KY-58 is in C (cipher) and a filled storage register is selected, this tone will be heard. Normal use (speaking) of the KY-58 is possible.

(2) When the KY-58 has successfully received a cryptovariable, this tone indicates that a "good" cryptovariable is present in the selected register.

(3) When you begin to receive a ciphered message, this tone indicates that the cryptovariable has passed the "parity" check, and that it is a good variable.

f. A single beep, when the RCU is in TD (Time Delay) occuring after the "preamble" is sent, indicates that you may begin speaking.

g. A single beep, followed by a burst of noise after which exists a seemingly "dead" condition indicates that your receiver is on a different variable than the distant transmitter. If this tone occurs when in cipher text mode: Turn RCU FILL switch to the CNV and contact the transmitter in PLAIN text and agree to meet on a particular variable.

SECTION II. NAVIGATION

3-35. DIRECTION FINDER SET — AN/ARN-89.

3-36. DESCRIPTION — DIRECTION FINDER SET.

The direction finder set (ADF) AN/ARN-89 (figure 3-9) is used in conjunction with gyromagnetic compass and intercommunications systems. ADF bearing information is indicated on the heading-radio bearing indicator (figure 3-10). The bearing pointer displays either the ADF bearing or the VOR bearing depending on the position selected on the RMI BRG PNTR switch. The ADF set operates in the 100 to 3,000 KHz frequency range and is used to receive continuous wave (cw) or amplitude modulated (am) radio frequency signals. The three modes of operation for the ADF set include automatic homing in the COMPASS mode, manual homing in the LOOP mode, and as a communications receiver in the ANTenna mode. A beat frequency oscillator is included to provide an audible indication for identification and tuning and is activated by the CW switch. The radio set control unit is marked ADF RCVR and is mounted in the center section of the instrument panel. Antenna locations are shown in figure 3-1.

3-37. CONTROLS AND FUNCTIONS — DIRECTION FINDER SET.

Refer to figure 3-9.

3-38. OPERATING PROCEDURES — DIRECTION FINDER SET.

a. A Comp.

(1) Function selector COMP.

(2) Frequency — Select. Tuning may be accomplished with function selector in COMP, ANT, or LOOP positions; however, less noise is encountered in the ANT position.

(3) AUDIO — Adjust.

(4) TUNE meter — Select. Tune for maximum up deflection of needle.

(5) CW VOICE TEST switch — TEST then release.

(6) Observe ADF needle indications.

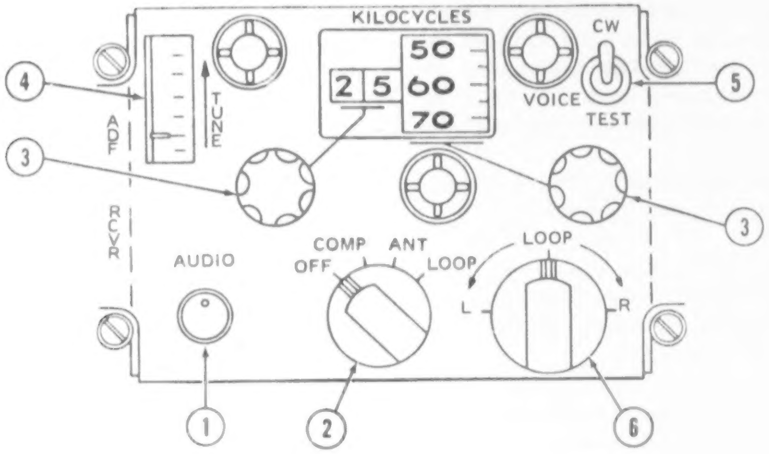
b. Loop.

(1) Function selector — LOOP.

(2) AUDIO — Adjust.

(3) CW VOICE TEST switch — CW.

(4) LOOP switch — Move left and right as required to obtain aural null.



CONTROL/INDICATOR	FUNCTION
1. AUDIO	Adjusts receiver volume.
2. Function Selector	
OFF	Power off.
COMP	Activates the ADF pointer on the radio bearing heading indicator **A** . Activates bearing pointer on HBI **C** .
ANT	Receiver provides aural information only.
LOOP	Receiver operates using only the loop antenna.
3. Frequency Selectors	
Left Selector	Selects first two digits of desired frequency.
Right Selector	Selects third and fourth digits of desired frequency.
4. TUNE Meter	Up deflection of the needle indicates most accurate tuning of the receiver when function selector is in the COMP position.
5. CW VOICE TEST Switch	
CW	Provides tone that may be used for identification, tuning, or for loop operation.
VOICE	Permits normal aural reception.
TEST	Rotates ADF needle 180° from original bearing to provide a check of needle accuracy with function selector in the COMP position. Inoperative in LOOP and ANT position. The switch is spring loaded away from TEST position.

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Figure 3-9. AN/ARN-89 (ADF) Control Panel (Sheet 1 of 2)

CONTROL/INDICATOR	FUNCTION
6. LOOP Switch	Used to rotate loop antenna by moving switch left or right. Direction and degree of turn are shown on the radio bearing heading indicator. Function selector must be in LOOP position.

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Figure 3-9. AN/ARN-89 (ADF) Control Panel (Sheet 2 of 2)

c. **C Preliminary.**

(1) Interphone control panel receiving NAV switch — ON.

(2) RMI BRG PTR switch — ADF.

(3) Function selector — COMP.

(4) Frequency — Select.

(5) AUDIO — Adjust.

(6) TUNE meter — tune for maximum up needle deflection.

d. **Manual Operation.**

(1) Function selector — LOOP.

(2) VOICE CW switch — CW.

(3) Rotate LOOP control for maximum reception and retune.

(4) Rotate LOOP control to find audible null position and adjust volume for a 5 to 8 degree null width.

(5) Check for ambiguity — The ADF bearing pointer will either read the magnetic bearing to the station or be 180 degrees out.

e. **Stopping Procedure.** Function Selector — OFF.

3-39. GYRO MAGNETIC COMPASS SET — AN/ASN-43.

3-40. DESCRIPTION — GYRO MAGNETIC COMPASS SET.

The gyro magnetic compass set provides accurate heading information, referenced to a free directional gyro heading when operated in the DIR gyro mode (free gyro), or slaved to the earth's magnetic field when operated in the MAG mode (magnetically slaved). It provides heading information in the form of a synchro output to the radio bearing heading indicator (and by presenting the magnetic heading as a reference signal to the VOR C).

3-41. CONTROLS AND FUNCTIONS — GYRO MAGNETIC COMPASS SET.

Refer to paragraph 3-42.

3-42. OPERATING PROCEDURES — GYRO MAGNETIC COMPASS SET.

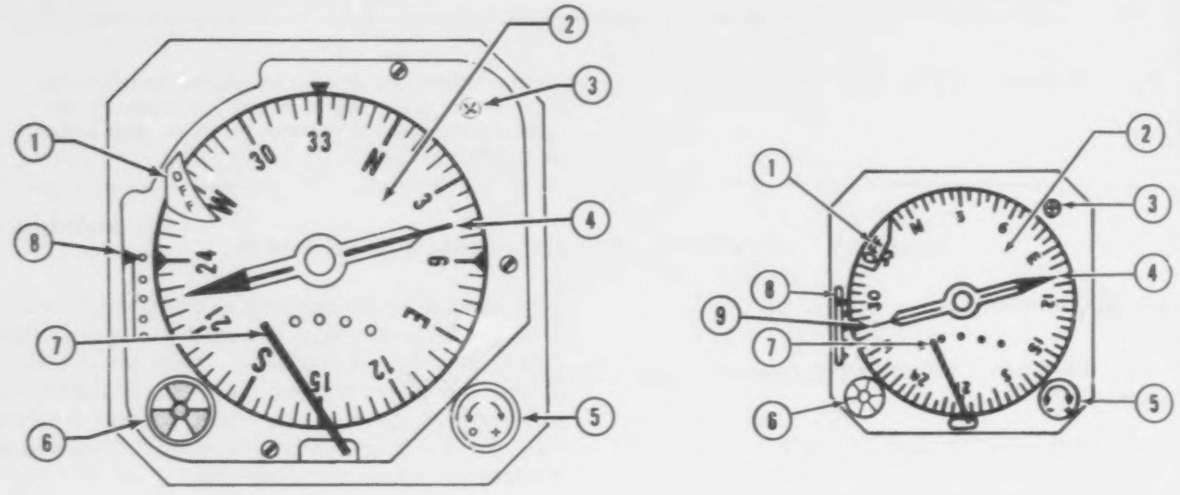
a. DIR GYRO/MAG switch — DIR GYRO for free gyro mode operation.

b. DIR GYRO/MAG switch — MAG for slaved mode operation.

3-43. RADIO BEARING HEADING INDICATOR — ID-1351A.

3-44. DESCRIPTION — RADIO BEARING HEADING INDICATOR.

The ID-1351/A A (ID-1351C/A C) indicator is mounted on the instrument panel and provides magnetic heading information and radio bearings by displaying information from the gyromagnetic compass set, ADF, (VOR C) and FM radios. Additionally, it provides visual indications of gyromagnetic compass failure, compass synchronization and approach to a radio station. The compass correction card for this instrument will be located in the front of the aircraft logbook.



ID-1351/A A

ID-1351 C/A C

CONTROL/INDICATOR	FUNCTION
1. Power Warning Indicator	Indicates when AC power is not being supplied to the gyromagnetic compass A . Indicates when AC power is not being supplied to the gyromagnetic compass or when the AN/ASN-43 AC power supply is inoperative C .
2. Heading Dial	Indicates the helicopter magnetic heading under the index.
3. Annunciator	Indicates by means of a dot (●) or cross (+) the direction the synchronizing knob (item 5) should be turned to give immediate and accurate synchronization.
4. ADF Pointer A	Indicates bearing of radio station from helicopter A .
5. Synchronizing Knob	Determines the heading synchronization.
6. Signal Strength Indicator	Indicates the presence or absence of FM radio signal.
7. Steering Indicator	Indicates helicopter deviation from a direct approach to the FM radio transmitter.
8. Station Approach Indicator	Indicates aircraft's approach to a FM radio transmitter.
9. Bearing Pointer C	Indicates bearing of radio station from helicopter (VOR or ADF as selected by RMI BRG PNTR switch) C .

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Figure 3-10. Radio Bearing Heading Indicator

3-45. CONTROLS AND FUNCTIONS — RADIO BEARING HEADING INDICATOR.

Refer to figure 3-10.

3-46. OPERATING PROCEDURES — RADIO BEARING HEADING INDICATOR.

a. Gyro-magnetic Heading Display and Synchronization.

(1) Gyro-magnetic heading dial rotates to indicate the helicopter's magnetic heading under the index.

(2) Heading synchronization is accomplished by rotating the synchronizing knob. The annunciator indicates, by means of a dot (●) or cross (+), the direction that the synchronizing knob should be turned to give immediate and accurate synchronization. If a cross (+) is showing in the annunciator, the synchronizing knob should be turned clockwise, and if a dot (●) is showing, the synchronizing knob should be turned counterclockwise. The system is synchronized when the annunciator indicates neither a dot (●) nor a cross (+). If, shortly after synchronizing the system, the heading dial drifts and a dot (●) or cross (+) appears in the annunciator, then the system was synchronized to a false null located 180 degrees from the correct heading and should be re-synchronized to the correct helicopter heading. The helicopter standby magnetic compass may be checked for reference.

b. ADF Pointer A (Bearing Pointer C). Radio magnetic bearing information is indicated by the ADF pointer of the indicator. The arrow end of this pointer indicates the bearing of the radio station from the helicopter. The ADF set furnishes the bearing information to the pointer (VOR or ADF as selected by the RMI BRG PTR switch located on the instrument panel C).

c. FM Homing.

(1) The steering indicator receives its input from the number 1 FM radio homing system. By moving to the right or left of its center indication, the indicator shows helicopter deviation from a direct approach path to the FM radio transmitter. The indicator moves to the right when the homing transmitter site is to the right of the helicopter, and to the left when the transmitter is to the left of the helicopter.

(2) An FM signal strength indicator shows red whenever the FM radio receiver signal is absent or is too weak for a reliable indication. When the signal strength is acceptable, the FM signal strength indicator shows black.

(3) The station approach indicator indicates helicopter approach to the FM radio transmitter. The pointer moves down as the transmitter is approached.

d. The power warning indicator comes into view whenever electrical AC power to the gyromagnetic compass is off, or inoperative.

3-47. C CONUS NAVIGATION RECEIVER.

NOTE

Keying of the AN/ARC-115, VHF-AM transmitter may cause the AN/ARN-123 VOR receiver to lose station lock-on. The RMI BRG PTR on the heading radio bearing indicator and the course pointer on the course deviation indicator will return to center position and the VOR NAV warning flag will appear. The VOR receiver will return to normal operation when the AN/ARC-115 transmitter is unkeyed.

3-48. DESCRIPTION — CONUS NAVIGATION RECEIVER.

The CONUS navigation receiver AN/ARN-123(V) receives the combined VOR (VHF omni-range) and LOC (localizer) signals over a frequency range of 108.00 to 117.95 MHz, GS (glideslope) signals over a frequency range of 329.15 to 335.00 MHz, and MB (marker beacon) signals on 75.00 MHz from ground transmitters. The receiver is controlled by the C-10048/ARN-123 control panel (figure 3-11) mounted on the lower right side of the instrument panel. The signals are visually displayed on the CDI (figure 3-12), and the marker beacon light as required. The VOR and localizer audio signals are received from ground transmitters through the helicopter intercommunications system by placing the interphone control (figure 3-2) AUX switch to ON. The set enables the operator to determine his present position, direction to a given point, and fly a predetermined flight path to localizer circuitry provides a visual display of the helicopter position relative to a localizer course. The marker beacon circuitry provides a visual display and aural tone to indicate helicopter position relative to a marker ground transmitter.

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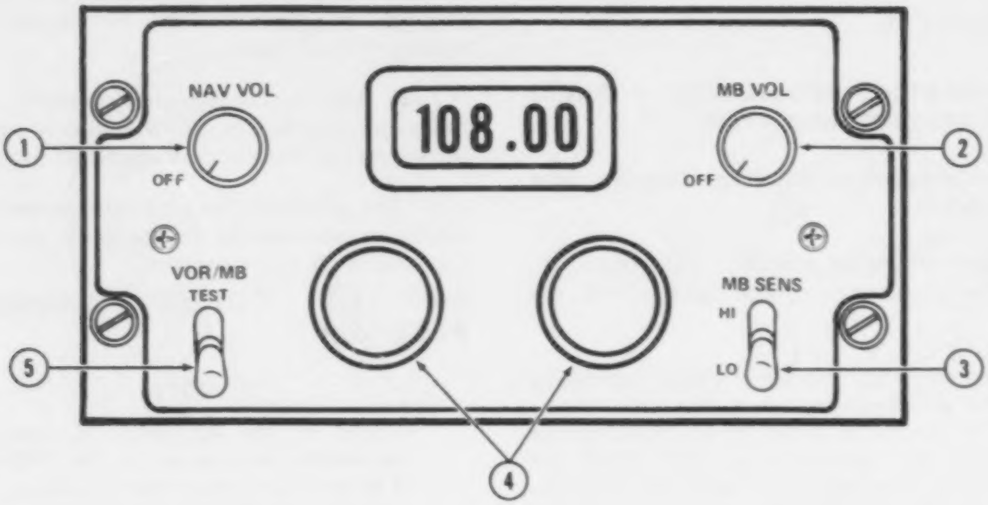

CONTROL/INDICATOR	FUNCTION
1. NAV VOL Power Switch and Volume Control	
NAV VOL	Turns set on and controls VOR/LOC receiver volume.
OFF	Turns set OFF.
2. MB VOL Power Switch and Volume Control	
MB VOL	Turns set on and controls marker beacon volume.
OFF	Turns set OFF.
3. MB SENS Switch	
HI	Selects high receiver sensitivity.
LO	Selects low receiver sensitivity.
4. Frequency Selectors	
Right	Selects the fractional megahertz portion of the desired frequency.
Left	Selects the whole megahertz portion of the desired frequency.
5. VOR/MB-TEST Switch	Provides on and off capability for the VOR/MB self-test circuit within the receiver.

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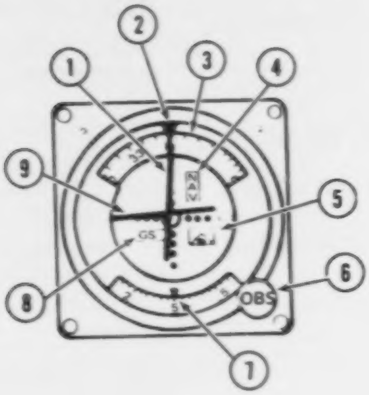
Figure 3-11. CONUS Navigation Receiver Control Panel C



CONTROL/INDICATOR	FUNCTION
1. Course Pointer	Indicates deviation from selected VOR radial or LOC path.
2. Course Index	Provides reference point for course deviation card.
3. Course Deviation Card	Manually rotated card, driven by OBS control to indicate desired VOR radial directly beneath course index.
4. NAV Warning Flag	Red NAV flag indicates VOR or LOC signal is unreliably weak or malfunction in receiver.
5. To/From Flag	Indicates whether flying selected radial would direct helicopter toward (TO) or from (FR) VOR station.
6. Omnibearing Selector (OBS)	Drives course deviation card for course selection.
7. Reciprocal Course Index	Indicates radial 180 degrees from selected radial.
8. Glide Slope Warning Flag	Red GS flag indicates GS signal is unreliably weak or malfunction in receiver.
9. Glide Slope Pointer	Indicates deviation from glidepath.

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Figure 3-12. Course Deviation Indicator (CDI) C

3-49. CONTROLS AND FUNCTIONS — CONUS NAVIGATION RECEIVER.

Refer to figure 3-11.

3-50. OPERATING PROCEDURES — CONUS NAVIGATION RECEIVER.

a. System Operation.

(1) NAV VOL switch control — On and adjust.

(2) MB VOL switch control — On and adjust.

(3) VOR/MB/TEST switch — Press and release.

(4) Frequency selectors — As required.

(5) MB SENS switch — As desired.

(6) RMI BRG PTR switch (located on instrument panel) — VOR.

(7) Interphone control panel AUX switch — ON.

(8) Interphone control panel VOL control — Adjust.

b. Stopping Procedure. NAV VOL and MB VOL switch controls — OFF.

3-51. C COURSE DEVIATION INDICATOR (CDI).

3-52. DESCRIPTION — COURSE DEVIATION INDICATOR.

The CDI ID-1347C/ARN (figure 3-12) is mounted on the right side of the instrument panel and displays VOR, LOC, and GS bearing information received from the CONUS navigation receiver. Additionally, it provides visual indications of unreliably weak VOR, LOC, and GS signals or equipment malfunction (NAV and GS flags), to/from station indication, and course selection.

3-53. CONTROLS AND FUNCTIONS — COURSE DEVIATION INDICATOR.

Refer to figure 3-12.

3-54. OPERATING PROCEDURES — COURSE DEVIATION INDICATOR.

Refer to figure 3-12.

SECTION III. TRANSPONDER AND RADAR

3-55. A TRANSPONDER SET — AN/APX-72.

3-56. A DESCRIPTION — TRANSPONDER SET.

The APX-72 (figure 3-13) provides a radar identification capability. Five independent coding modes are available to the pilot. The first three modes may be used independently or in combination. Mode 1 provides 32 possible code combinations, any one of which may be selected in flight. Mode 2 provides 4,096 possible code combinations but only one is available since the selection dial is not available in flight and must be preset before flight. Mode 3/A provides 4,096 possible codes, any of which may be selected in flight. Mode C, in this installation, is not utilized. Mode 4, which is connected to an external computer, can be programmed prior to flight to display any one of many classified operational codes for security identification. The effective range depends on the capability of interrogating radar and line-of-sight. The code setting can be mechanically retained. On the instrument Panel and Console — place the IFF CODE HOLD-OFF switch to the HOLD position. On the Transponder Set Control Panel — turn the Code switch to HOLD (only momentary action is required) and turn the MASTER switch or helicopter power OFF within 10 seconds after the CODE switch has been turned to the HOLD position momentarily. If the power is not removed in 10 seconds or less, the code hold will not be retained. The transponder set is mounted on the upper left side of the instrument panel. The associated antenna is shown in figure 3-1.

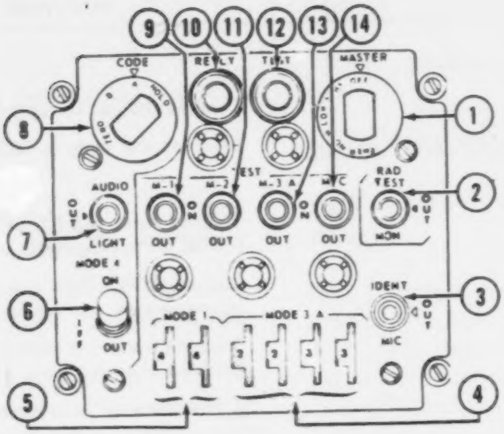
3-57. A CONTROLS AND FUNCTIONS — TRANSPONDER SET.

The control panel is located on the instrument panel. It provides remote control of the APX-72 transponder set. Mode 2 code select switch is on the front panel of the receiver-transmitter radio. Controls and functions are shown in figure 3-13.

3-58. A OPERATING PROCEDURES — TRANSPONDER SET.

a. Transponder Operation.

(1) MASTER control — STBY. Allow approximately 2 minutes for warmup.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OUT
M-2
OUT
M-3 A
ON
OUT
M-C
OUT
RAD
TEST
OUT
MON
2
MODE 4
ON
6
IFF
OUT
IDENT
OUT
MIC
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MODE 1
MODE 3 A
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2
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3
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4

CONTROL/INDICATOR	FUNCTION
1. MASTER Control	
OFF	Turns set OFF.
STBY	Places in warmup (standby) condition.
LOW	Set operates at reduced receiver sensitivity.
NORM	Set operates at normal receiver sensitivity.
EMER	Transmits emergency replay signals to MODE 1, 2, or 3/A interrogations regardless of mode control settings.
2. RAD TEST—MON Switch	
RAD TEST	Enable set to reply to TEST mode interrogations. Other functions of this switch position are classified.
MON	Enables the monitor test circuits.
OUT	Disables the RAD TEST and MON features.
3. IDENT-MIC Switch	
IDENT	Initiates identification reply for approximately 25 seconds.
OUT	Prevents triggering of identification reply. Spring loaded to OUT.
MIC	Not used.
4. MODE 3/A Code Select Switches	Selects and indicates the MODE 3/A four-digit reply code number.
5. MODE 1 Code Select Switches	Selects and indicates the MODE 1 two-digit reply code number.

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Figure 3-13. Transponder APX-72 Control Panel A (Sheet 1 of 2)

CONTROL/INDICATOR	FUNCTION
6. MODE 4 Switch	
ON	Enables the set to reply to MODE 4 interrogations.
OUT	Disables the reply to MODE 4 interrogations.
7. AUDIO-LIGHT Switch	
AUDIO	Enables aural and REPLY light monitoring of valid MODE 4 interrogations and replies.
LIGHT	Enables REPLY light only monitoring of valid MODE 4 interrogations and replies.
OUT	Disables aural and REPLY light monitoring of valid MODE 4 interrogations and replies.
8. CODE Control	Holds, zeroizes or changes MODE 4 code.
9. M-1 Switch	
ON	Enables the set to reply to MODE 1 interrogations.
OUT	Disables the reply to MODE 1 interrogations.
TEST	Provides test of MODE 1 interrogations by indication on TEST light.
10. REPLY Indicator	Lights when valid MODE 4 replies are present, or when pressed.
11. M-2 Switch	
ON	Enables the set to reply to MODE 2 interrogations.
OUT	Disables the reply to MODE 2 interrogations.
TEST	Provides test of MODE 2 interrogation by indication on TEST light.
12. TEST Indicator	Lights when the set responds properly to a M-1, M-2, M-3/A or M-C test, or when pressed. NOTE: Computer must be installed before set will reply to a MODE 4 interrogation.
13. M-3/A Switch	
ON	Enables the set to reply to MODE 3/A interrogations.
OUT	Disables the reply to MODE 3/A interrogations.
TEST	Provides test of MODE 3/A interrogation by indication on TEST light.
14. M-C Switch	Not used.

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Figure 3-13. Transponder APX-72 Control Panel A (Sheet 2 of 2)

(2) Mode and code — Select as required.

(3) Test as required.

(4) MASTER control — LOW, NORM, ENER as required.

(5) IDENT — As required.

b. **Stopping Procedure.** MASTER control — OFF.

3-59. C TRANSPONDER SET — AN/APX-100.

a. **Description.** The transponder set AN/APX-100, enables the helicopter to identify itself automatically when properly challenged by friendly surface and airborne radar equipment. The control panel (figure 3-14), located on the instrument panel, enables the set to operate in modes 1, 2, 3A, 4, C, and test. When computer KIT-1A/TSEC (classified) is installed, mode 4 is operational. The range of the receiver-transmitter is limited to line-of-sight transmission since its frequency of operation is in the UHF band making range dependent on altitude. The Mode 4 codes can be mechanically retained. On the Instrument Panel and Console — place the HOLD-OFF switch to the HOLD position. On the Transponder Set Control Panel — turn the CODE switch to HOLD (only momentary action is required) and turn the MASTER switch or helicopter power OFF within 10 seconds after the CODE switch has been turned to the HOLD position momentarily. If the power is not removed in 10 seconds less, the code hold will not be retained.

b. **Controls and Functions.** Refer to figure 3-14.

c. **Operating Procedures.**

(1) **Transponder Operation.**

(a) MASTER control — STBY. Allow approximately 2 minutes for warmup.

(b) MODE and CODE — Select as required.

(c) TEST — As required.

(d) MASTER control — NORM or EMER as required.

(e) ANT — As desired.

(f) IDENT — As required.

(2) **Emergency Operation.** MASTER control — EMER.

(3) **Stopping Procedure.** MASTER control — OFF.

3-60. PROXIMITY WARNING DEVICE.

3-61. DESCRIPTION — PROXIMITY WARNING DEVICE.

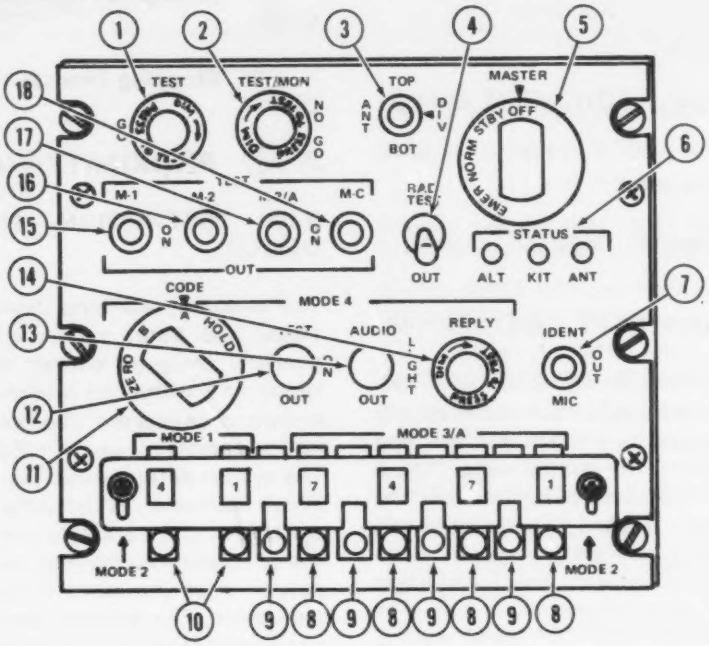
The proximity warning device warns the pilot by visual and aural means whenever one or more similarly equipped aircraft are within a selectable range and within an altitude of ± 300 feet of the protected helicopter. The proximity warning device has selectable ranges of 1000, 3000, and 5000 feet. The system differentiates between aircraft which are above helicopter, at the same altitude and those that are below. It, accordingly, issues a visual warning to the pilot and informs him that an intruder is above, below, or at the same altitude as his "protected" helicopter. The system operates on a cooperative basis with other aircraft having like equipment. The system is in effect a modified C-band pulse beacon ranging system with electronic comparison of relative altitude. The system is furnished with two "stub" antennas. Its weight is approximately 5.2 pounds and it requires 28 VDC power and pitot-static system inputs. Warning outputs are three lights blinking at 3 Hz and a single 1600 Hz audio tone. Volume control is provided. (Refer to figure 3-15.)

3-62. CONTROLS AND FUNCTIONS — PROXIMITY WARNING DEVICE.

Refer to figure 3-15 for controls and functions of all receiver-transponder panel controls and lamps.

3-63. OPERATING PROCEDURES — PROXIMITY WARNING DEVICE.

The operating instructions for the system are of two types: system engagement and system test. To engage the system, the receiver-transponder panel POWER switch is set to ON and the RANGE SELECT switch is set to the desired range position. To test the system, the receiver-transponder panel TRANSPONDER GND TEST/CONFIDENCE TEST switch is set and held at the desired test position. To remove power, turn POWER switch to OFF.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
TEST
GO
TEST/MON
NO GO
TOP
ANT
DIV
BOT
MASTER
EMER NORM STBY OFF
TEST
M-1
M-2
M-C
ON
OUT
RAD TEST
OUT
STATUS
ALT
KIT
ANT
CODE
MODE 4
A
B
HOLD
ZERO
AUDIO
LIGHT
OUT
REPLY
PRESS
IDENT
OUT
MIC
MODE 1
MODE 3/A
4
1
7
4
7
1
MODE 2
MODE 2

CONTROL/INDICATOR	FUNCTION
1. TEST GO	Indicates successful built in test (BIT).
2. TEST/MON NO GO	Indicates unit malfunction.
3. ANT	
TOP	Selects antenna located on top of helicopter.
BOT	Selects antenna located on bottom of helicopter.
DIV	Selects both top and bottom antenna.
4. RAD TEST Switch	
RAD TEST	Enables set to reply to TEST mode interrogations.
OUT	Disables to RAD TEST features.
5. MASTER Control	
OFF	Turns set OFF.
STBY	Places in warmup (standby) condition.
NORM	Set operates at normal receiver sensitivity.
EMER	Transmits emergency replay signal to MODE 1, 2, or 3/A interrogations regardless of mode control settings.

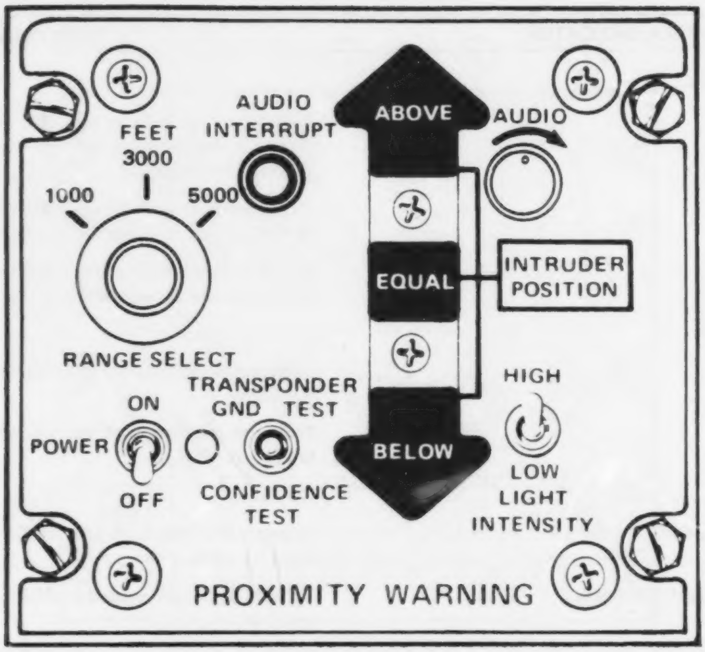
206075-268-1

Figure 3-14. Transponder Set Control Panel **C** (Sheet 1 of 2)

CONTROL/INDICATOR	FUNCTION
6. STATUS Indicators.	
ANT	Indicates that built in test (BIT) or monitor (MON) failure is due to high voltage standing wave ratio (VSWR) in antenna.
KIT	Indicates that built in test (BIT) or monitor (MON) failure is due to external computer.
ALT	Indicates that built in test (BIT) or monitor (MON) failure is due to altitude digitizer.
7. IDENT-MIC Switch	
IDENT	Initiates identification reply for approximately 25 seconds.
OUT	Prevents triggering of identification reply. Spring loaded to OUT.
MIC	Not used.
8. MODE 3/A Code Select Switches	Selects and indicates the MODE 3/A four-digit reply code number.
9. MODE 2 Code Select Switches	Selects and indicates the MODE 2 four-digit reply code number.
10. MODE 1 Code Select Switches	Selects and indicates the MODE 1 two-digit reply code number.
11. MODE 4/CODE Control HOLD/A/B/ZERO	Selects condition of code changer in remote computer. Functions of this switch are operationally classified.
12. MODE 4/TEST Switch	
TEST	Selects MODE 4 BIT operation.
ON	Selects MODE 4 ON operation.
OUT	Disables MODE 4 operation.
13. MODE 4 AUDIO/LIGHT Control	
AUDIO	MODE 4 is monitored by audio.
LIGHT	MODE 4 is monitored by a light.
OUT	MODE 4 not monitored.
14. MODE 4/REPLY	Indicates that a MODE 4 REPLY is generated.
15. TEST/M-1	
TEST/ON/OUT	Selects ON, OFF, or BIT of MODE 1 operation.
16. TEST/M-2	
TEST/ON/OUT	Selects ON, OFF, or BIT of MODE 2 operation.
17. TEST/M-3/A	
TEST/ON/OUT	Selects ON, OFF, or BIT of MODE 3/A operation.
18. TEST/M-C	
TEST/ON/OUT	Selects ON, OFF, or BIT of MODE C operation.

206075-268-2

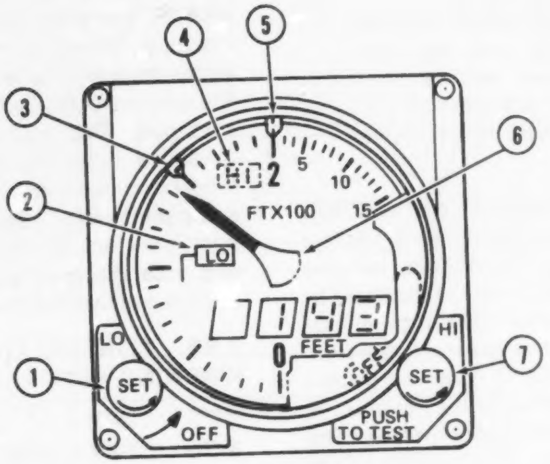
Figure 3-14. Transponder Set Control Panel C (Sheet 2 of 2)


AUDIO
INTERRUPT
FEET
3000
1000
5000
RANGE SELECT
ABOVE
AUDIO
EQUAL
INTRUDER
POSITION
HIGH
BELOW
TRANSPONDER
GND TEST
ON
POWER
OFF
CONFIDENCE
TEST
LOW
LIGHT
INTENSITY
PROXIMITY WARNING

CONTROL/INDICATOR	FUNCTION	
POWER ON/OFF Switch	Turns set on and off.	
POWER Lamp	Indicates when set is on.	
RANGE SELECT Switch	Sets range gate circuitry to accept a reply signal within selected distances.	
AUDIO INTERRUPT Pushbutton Switch	Silences audio alarm signal for approximately one minute.	
INTRUDER POSITION Indicator Lamps	Flash singly or in combination to indicate position of intruder as follows:	
	FLASHING LAMP(S)	RELATIVE INTRUDER POSITION
	ABOVE	Between 110 and 300 feet above
	ABOVE and EQUAL	Between 80 and 110 feet above
	EQUAL	Between 80 feet above and 80 feet below
	EQUAL and BELOW	Between 80 and 110 feet below
	BELOW	Between 110 and 300 feet below
AUDIO Control	Varies the volume of the audio tone.	
Light Intensity Switch	Switches INTRUDER POSITION and POWER indicator lamps to LOW or HIGH intensity.	
TRANSPONDER GND TEST/CONFIDENCE	In TRANSPONDER GND TEST position, permits unit to accept signals from ground transponder. In CONFIDENCE TEST position, switch initiates confidence test.	

206075-269

Figure 3-15. Operating Controls for Proximity Warning System



ALTIMETER

CONTROL/INDICATOR	FUNCTION
1. LO SET Control Knob	Turns facility on and off, and sets low altitude limit index.
2. LO Level Warning Flag	Indicates LO when altitude reaches respective limit index.
3. Low Limit Index	Manually sets low altitude limit index. Actuates LO level warning flag when limit reached.
4. HI Level Warning Flag	Indicates HI when altitude reaches respective limit index.
5. High Limit Index	Manually sets high altitude limit index. Actuates HI level warning flag when limit reached.
6. Altitude Pointer	Indicates actual clearance in feet from helicopter to terrain (zero to 1500 feet).
7. HI SET Control Knob	Sets high altitude limit index and operates self-test mode.

206075-270

Figure 3-16. Radar Altimeter C

3-64. C RADAR ALTIMETER.

NOTE

> Simultaneous operation of the AN/APR-39, radar warning receiver and the AN/APN-209 radar altimeter will cause a strobe to appear on the AN/APR-39 CRT and an audio tone can be heard in the headset for IGE hover.

3-65. DESCRIPTION — RADAR ALTIMETER. The radar altimeter AN/APN-209 (figure 3-16) is a short pulse, terrain tracking and altitude sensing radar system that measures and visually indicates by pointer and digital display actual clearance in feet between the helicopter and terrain over a range from zero to 1500 feet. The indicator contains all the electronic components necessary for the generation, reception, and tracking of the radar pulses. The indicator provides precise altitude indications with a manually set low-level and high-level warning flag to warn when a predetermined low or high altitude limit has been reached.

3-66. CONTROLS AND FUNCTIONS — RADAR ALTIMETER.

Refer to figure 3-16.

3-67. OPERATING PROCEDURES — RADAR ALTIMETER.

a. **Altimeter Operation.**

(1) LO SET control knob — Clockwise from OFF. Set low limit index as desired.

(2) HI SET control knob — As desired to set high limit index as desired.

b. **Self-Test Operation.**

(1) Set high limit index to 800 feet and low limit index to 50 feet.

(2) Push and hold HI SET control knob. Verify pointer indicates 1000 (±175) feet, digital display reads 1000 (±100) feet, and HI level warning flag is exposed.

(3) Release HI SET control knob. Verify pointer indicates 0(±5) feet, digital display reads 0 to 3 feet, and LO warning flag is exposed.

c. **Stopping Procedure.** LO SET control knob — Counterclockwise from LO.

3-68. RADAR WARNING SET.

a. **Description.** The radar warning set AN/APR-39 provides the pilot with visual and audible warning when a hostile fire-control threat is encountered. The equipment responds to hostile fire-control radars but nonthreat radars are generally excluded. The equipment also receives missile guidance radar signals and, when the signals are time-coincident with a radar tracking signal, the equipment identifies the combination as an activated hostile surface-to-air (SAM) radar system. The visual and aural displays warn the pilot of potential threat so that evasive maneuvers can be initiated.

3-69. CONTROLS AND FUNCTIONS — RADAR WARNING SET.

Refer to figure 3-17.

3-70. OPERATING PROCEDURES — RADAR WARNING SET.

a. **System Operation.**

NOTE

> For simultaneous operation of the AN/APR-39, radar warning receiver and the Proximity Warning System (PWD), the PWD will cause a strobe to appear on the AN/APR-39 CRT and an audio tone can be heard in the headset. For simultaneous operation of the systems, place the AN/APR-39 DSCRM switch to the ON position. For proper operation of the AN/APR-39 with the DSCRM switch OFF, the PWD must be OFF.

(1) PWR switch — ON.

(2) AUDIO control — Adjust.

(3) BRIL control — Adjust.

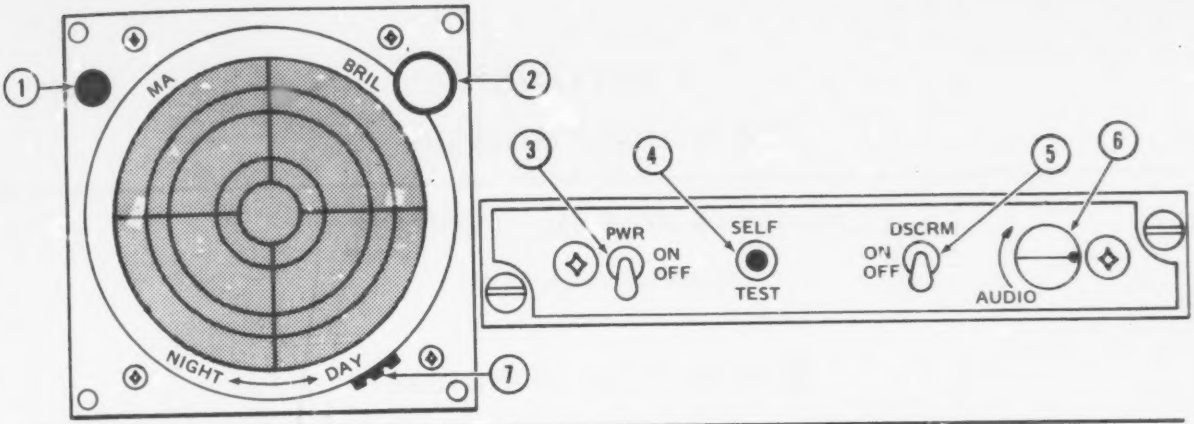
(4) NIGHT-DAY control — Adjust.

b. **Self-Test Operation.**

(1) SELF-TEST switch — Press SELF-TEST switch. Within approximately three seconds the indicator should display a forward (0 degrees) or aft (180 degrees) strobe and an audio tone is heard.

(2) Approximately three seconds later, the opposite strobe should appear and the audio tone becomes stronger.

c. **Stopping Procedure.** PWR Switch — OFF.



CONTROL/INDICATOR	FUNCTION
1. MA Indicator	Flashing indicates high radar missile threat with DSCRM switch in ON.
2. BRIL Control	Adjusts indicator illumination.
3. PWR Switch:	
ON	Turns set on.
OFF	Turns set off.
4. SELF TEST Switch:	
With DSCRM Switch OFF, PWR Switch ON. NOTE: One minute warmup. Press and hold SELF TEST. Monitor CRT and AUDIO.	Forward and aft strobes appear, extending to approximately the third circle on the indicator graticule and 2.5 KHz PRF audio is present immediately.
Rotate BRIL Control CW & CCW.	Within approximately 6 seconds, alarm audio will be present and MA lamp will start flashing.
Rotate AUDIO Control between maximum CCW and maximum CW.	Indicator strobes brighten (CW) and dim as control is rotated (CCW).
Release SELF TEST	Audio not audible at maximum CCW and clearly audible at maximum CW.
5. DSCRM Switch:	
OFF	Without missile activity — Provides strobe lines for ground radar and normal audio indications. With missile activity — Provides strobe lines for ground radar, flashing strobe line(s) for missile activity, and flashing MA (missile alert) light.
ON	Without missile activity — No indications. With missile activity — Flashing strobe lines for missile activity (no strobe lines for ground radar), flashing MA light, and audio warning (whaling) tone.
6. AUDIO Control	Adjusts radar warning audio volume.
7. NIGHT-DAY Control	Polarized and red filter for night or day operation.

206075-271

Figure 3-17. Radar Warning Indicator and Control

CHAPTER 4

MISSION EQUIPMENT

SECTION I. MISSION AVIONICS

(NOT APPLICABLE)

SECTION II. ARMAMENT A

4-1. ARMAMENT SUBSYSTEM M27E1.

The armament subsystem M27E1 is used on the left side of OH-58A helicopter. The helicopter is equipped with complete cabling and installation provisions for the M27E1, making modification of the subsystem unnecessary. The subsystem can be completely removed or installed in a minimum amount of time to allow helicopter to be employed in a different mode of operation. The major components of the subsystem are: the gun assembly containing a 7.62 millimeter machine gun M134, a delinking feeder, and an electric gun drive assembly; a mount assembly containing an electrical system assembly, a control rod assembly and an ammunition container assembly; a ram air duct assembly and a reflex sight assembly M70E1 (figures 4-1 and 4-2).

4-2. ARMAMENT TABULATED DATA.

a. Machine Gun M134.

(1) Caliber .... 7.62 millimeter

(2) Cooling .... Air

(3) Rate of fire: Low .... 2000 spm
High .... 4000 spm

(4) Rotation of barrels ..... Counterclockwise (Viewed from breech end)

b. Ammunition Authorized.

(1) 7.62 Millimeter ball cartridge M59 (NATO)

(2) 7.62 Millimeter ball cartridge M80 (NATO)

(3) 7.62 Millimeter tracer cartridge M62 (NATO)

(4) 7.62 Millimeter armor piercing cartridge M61 (NATO)

CAUTION

Do not use fluted case dummy cartridges.

(5) 7.62 Millimeter dummy cartridge M172 (inert loaded)

4-3. ARMAMENT CONTROL SYSTEM.

The control system consists of trigger and elevation/depression switches on the pilot and copilot cyclic stick grips and an ARMAMENT control panel (figure 4-3) located in the instrument panel. The control panel contains a three-position MASTER switch, warning lights marked GUN NOT CLEARED, ARMED and AMMO LOW, and a two-position toggle switch that mechanically locks in the SAFE position. The function of the various controls and indicator lights are as follows:

NOTE

Gun elevation/depression and firing can be accomplished with the switches located on the pilot and copilot cyclic stick grip Except for sighting, all of the following information is applicable to the copilot position as well as the pilot seat location. The reflex sight cannot be used from the copilot seat position.

a. MASTER Switch. Off position disconnects the ARMED-SAFE switch circuit and gun firing control circuit from ARM circuit breaker.

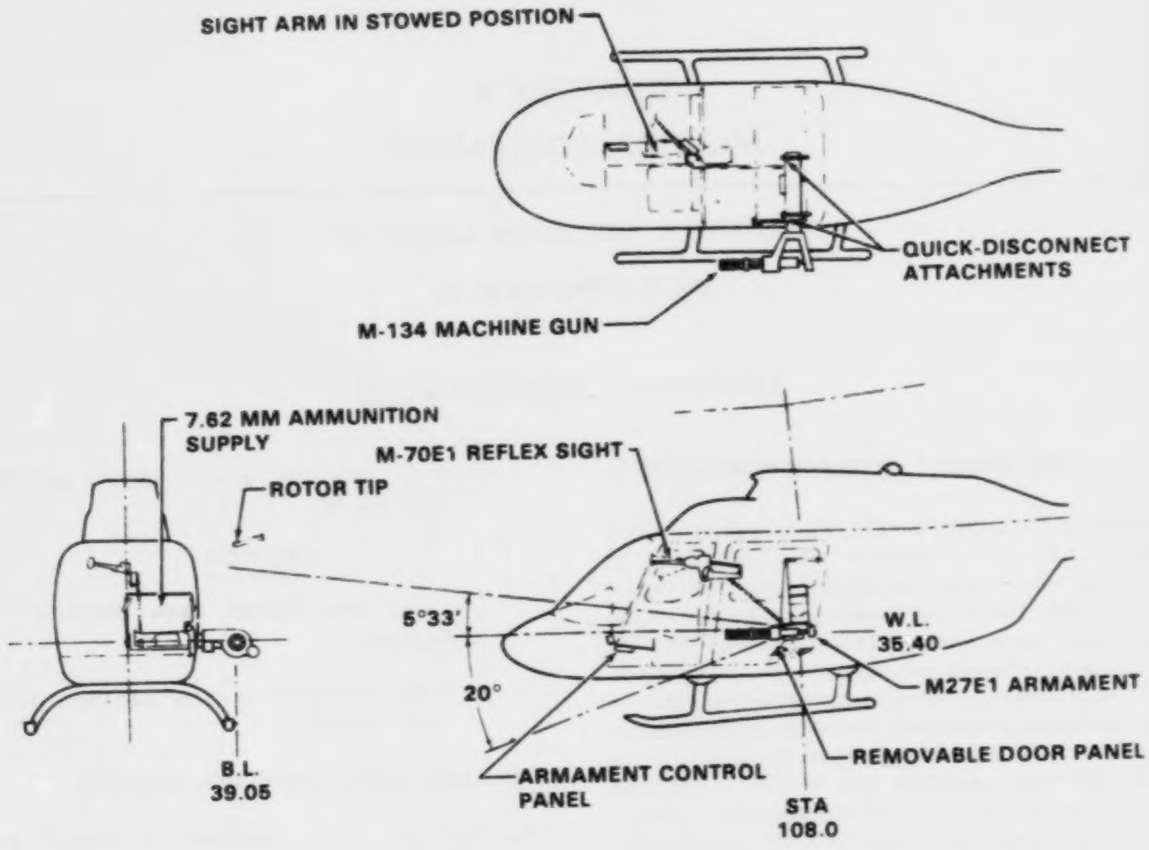

SIGHT ARM IN STOWED POSITION
QUICK-DISCONNECT ATTACHMENTS
M-134 MACHINE GUN
7.62 MM AMMUNITION SUPPLY
M-70E1 REFLEX SIGHT
ROTOR TIP
5°33'
W.L. 35.40
M27E1 ARMAMENT
20°
REMOVABLE DOOR PANEL
ARMAMENT CONTROL PANEL
B.L. 39.05
STA 108.0
206071-28

Figure 4-1. Components of Armament System **A**

WARNING

Just placing the master switch in the FIRE TO CLEAR position does not clear the gun; it is necessary to fire a one second or longer burst in order to complete the gun clearing. Firing is still possible when the GUN NOT CLEARED light is out. It is important to understand that ammunition remains in the delinking feeder after each gun clearing. The gun will fire again when the trigger is pulled.

b. Fire to Clear Position. Connects the armament subsystem firing control circuits so that the gun motor will continue to operate for an additional 0.2 seconds after the trigger is released (gun feed solenoid on feeder disengaged) thereby firing remaining rounds in the gun chambers and ejecting live rounds from the feeder. De-energizing is caused by trigger release or the automatic 3-second burst limits if the trigger is not released within three seconds. The GUN NOT CLEARED light will extinguish after a successful clearing burst has been fired. After the gun has been cleared, firing may be resumed by merely pulling the trigger switch. The reflex sight reticle lamp remains illuminated as long as the MASTER switch is in FIRE TO CLEAR.

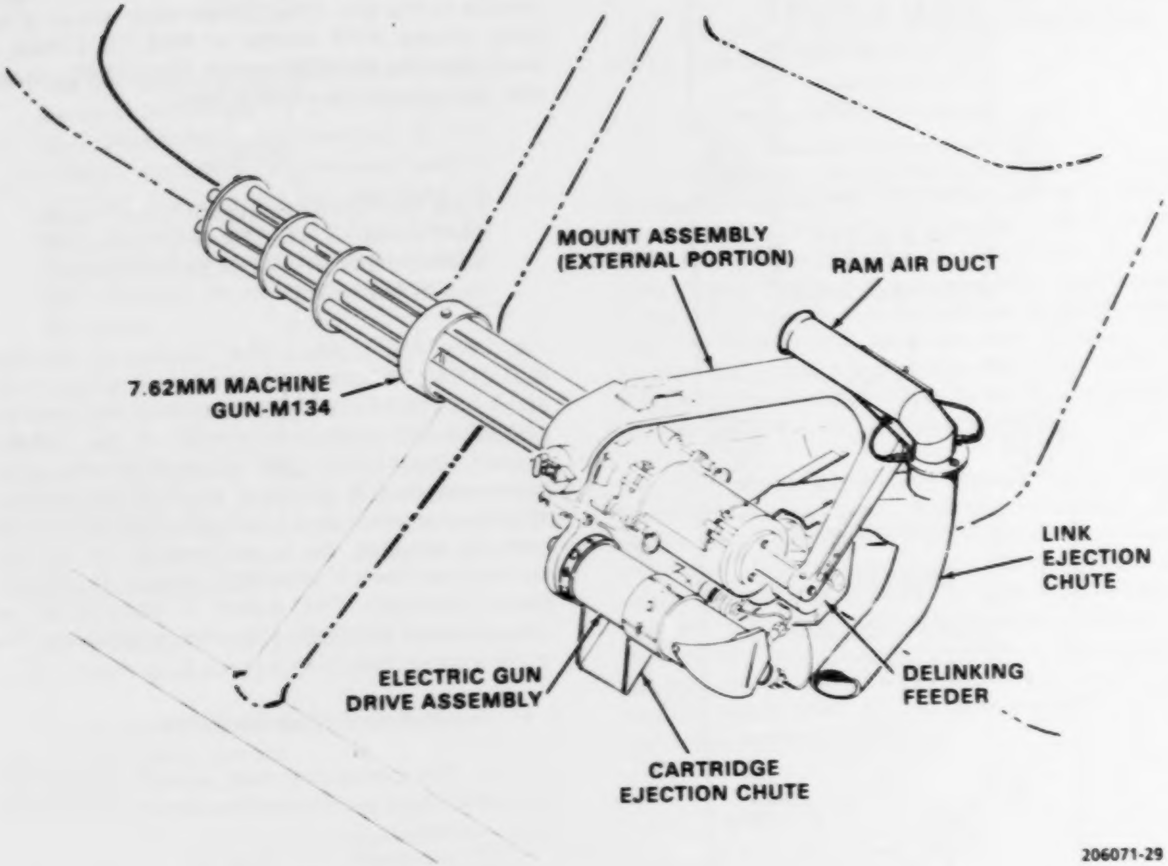

MOUNT ASSEMBLY
(EXTERNAL PORTION)
RAM AIR DUCT
7.62MM MACHINE
GUN-M134
LINK
EJECTION
CHUTE
ELECTRIC GUN
DRIVE ASSEMBLY
DELINKING
FEEDER
CARTRIDGE
EJECTION CHUTE
206071-29

Figure 4-2. Gun Assembly Mounted **A**

NOTE

Each gun clearing burst will jettison 30 to 35 live rounds in low rate after firing ceases. For this reason, it is recommended that the FIRE TO CLEAR mode be used principally for gun clearing and that all anticipated or normal firing will be accomplished in the FIRE NORM mode. To conserve ammunition the M27 clearing bursts should be fired at the LOW rate whenever possible. It is normal for GUN NOT CLEARED light to remain ON when the ammunition supply is exhausted. If the AMMO LOW light is ON and the gun barrels are observed to rotate without firing during the gun clearing operation, the ammunition supply is exhausted.

c. **Fire Norm Position.** Connects the armament subsystem firing control circuits so that ammunition continues to be fed to the gun while it is coasting to a stop for one-half second after trigger release or cutoff by the 3-second burst limiter. In this way, the gun remains fully loaded for immediate firing. In the FIRE NORM mode, the GUN NOT CLEARED light will illuminate only after the trigger switch has been pulled. The reflex reticle lamp remains illuminated at all times.

WARNING

When the gun is not cleared any rotation of the gun barrels will cause the gun to fire.

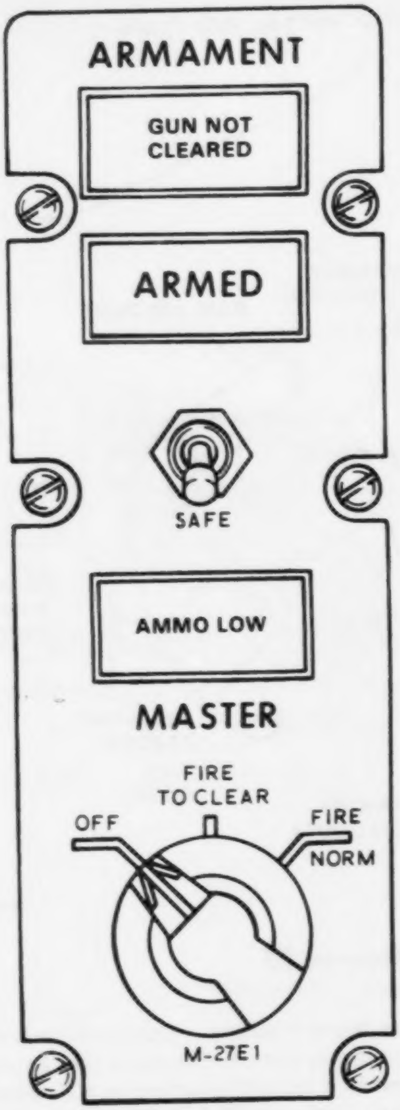


Figure 4-3. Armament Control Panel **A**

NOTE

Turning the MASTER switch to the OFF position will not turn off the GUN NOT CLEARED light. The light is wired to prevent it from being turned off until the gun has been cleared.

d. Armed-Safe Switch.

(1) SAFE position disconnects the cyclic grip trigger switch circuits from the MASTER switch and the ARM circuit breaker.

(2) ARMED position connects cyclic trigger circuits to the gun firing circuit when either of the firing modes (FIRE NORM or FIRE TO CLEAR) is selected on the MASTER switch. The ARMED position also illuminates the ARMED light.

NOTE

If the ARMED-SAFE switch is returned to SAFE while the MASTER switch is set FIRE NORM, the GUN NOT CLEARED light will remain illuminated.

e. Warning Lights. The function of the GUN NOT CLEARED light is described in paragraphs 4-3b and 4-3d. The ARMED light illuminates whenever the ARMED-SAFE switch is moved to the ARMED position. The AMMO LOW light is illuminated when approximately 400 rounds of ammunition remain or after 6 seconds of fire at a high rate. The AMMO LOW light is actuated by a microswitch in the low ammunition switch assembly located on the gun mount assembly. The switch is operated by an actuator block located in the lower leveler assembly in the ammunition box.

f. Cyclic Grip Trigger Switches.

(1) The switch first step position actuates the low (2000 shots per minute) fire rate circuit of the gun drive motor.

(2) Generator Out, Caution Light On. If helicopter DC GENERATOR caution light illuminates, any additional firing should be accomplished at the high rate.

NOTE

Firing two thousand rounds will consume approximately twelve percent of the energy of a fully charged battery.

g. Cyclic Grip Elevation/Depression Switches. When the ARM circuit breaker is depressed, the elevation/depression switches have a continuous supply of power that is unaffected by the position of any of the other control system switches. Pushing the switch depresses the gun 20 degrees from level; pulling the switch elevates the gun 5 1/2 degrees above level.

CAUTION

The elevation/depression motor has no limit switches. To prevent elevation drive motor overheating, do not hold the elevation/depression switch on after the system has reached its limit of travel. System's limit can be determined when movement of sight has stopped in either depression or elevation.

h. **Cooling.** The M134 Machine Gun on various armament subsystems have firing burst limiting controls varying gun on time from three to six seconds. Burst of fire, intermittent burst lasting six seconds in duration shall be succeeded by the following cooling period.

(1) HOVER or on ground. Six second burst followed by two minute cooling period.

(2) FLIGHT. Six second burst followed by a one minute cooling period.

4-4. GUNNERY EQUIPMENT.

a. The gun is a 7.62 millimeter machine gun M134. (See paragraph 4-2a.)

b. **Gun Sight M70E1.** (Figure 4-4.)

(1) **Plunger Assembly and Detent.** The plunger assembly is located on the end of the sight operating arm. The detent is centrally located on the left side of the reticle housing. When sight is to be used, the operating arm is swung out of its stowed position to the right until the plunger assembly rides over the detent and locks the arm in operating position. Two plate stops, one on the reticle housing and one on the clevis of the pivot arm, assure positive positioning of the sight for operating use.

(2) **Height Adjustment Knob.** This adjustment knob provides a means for locking the sight at a convenient viewing height, depending upon individual pilot's eye level. Counterclockwise rotation of the knob unlocks the sight to be raised or lowered within its adjustment range. Clockwise rotation of the knob locks the sight at the selected position. When extreme gun depression angles are used, a higher than normal sight adjustment level will make sighting easier.

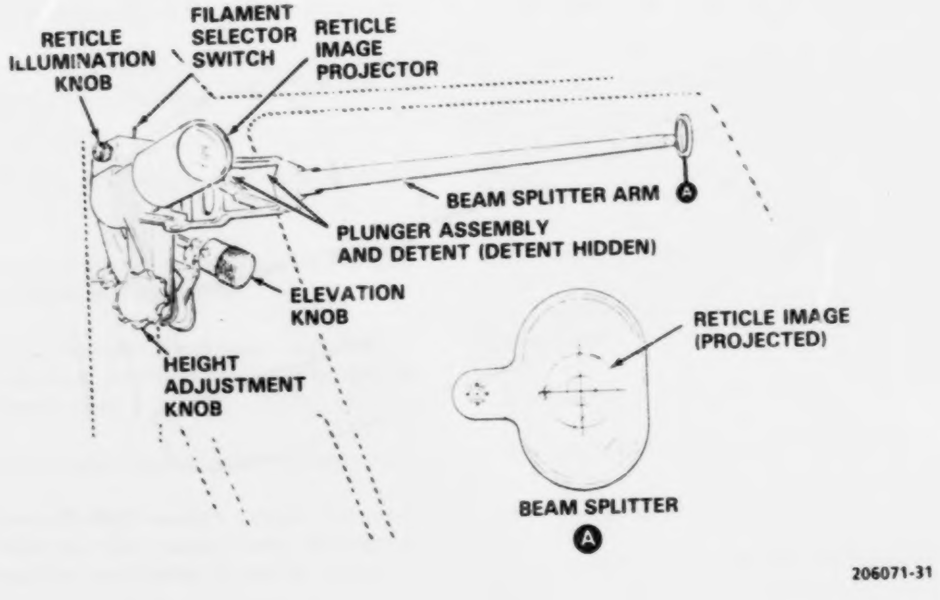

RETICLE ILLUMINATION KNOB
FILAMENT SELECTOR SWITCH
RETICLE IMAGE PROJECTOR
BEAM SPLITTER ARM
A
PLUNGER ASSEMBLY AND DETENT (DETENT HIDDEN)
ELEVATION KNOB
HEIGHT ADJUSTMENT KNOB
RETICLE IMAGE (PROJECTED)
BEAM SPLITTER
A
206071-31

Figure 4-4. Reflex Sight M70E1 Control and Reticle A

(3) **Elevation Control Assembly Knob.** This adjustment knob is used to set the sight for a preselected anticipated target distance. A white numerical scale on the rotating portion of the knob is graduated in meters, with a range of 0 to 1000. The range is selected by rotating the knob until the anticipated target range marking is aligned with the white index arrow adjacent to the knob scale. When the expected target range has been set, the sight is adjusted for the gravity drop of the projectiles at that range. If the target being fired upon is at the selected range, the center of the reticle will coincide with the point of impact. At shorter or longer distances, it will be necessary to maneuver the aircraft to lower or raise the sight reticle a proportionate distance below or above the aiming point.

NOTE

The yellow range markings should be locked out of position when the M27E1 subsystem is being used.

(4) **Filament Selector Switch.** The filament selector switch receives electrical power from the ARM circuit breaker and MASTER switch. The filament selector switch is a two-position toggle switch located on top of the lamp housing. When moved to either position, one filament of the reticle lamp is illuminated. The forward switch position is the normally used position. The rear position (spare filament) should only be used after failure of the normal or primary filament. The reticle is illuminated when either filament is selected.

(5) **Reticle Illumination Knob.** The reticle illumination knob is located on the upper portion of the lamp housing. Clockwise rotation of the knob increases reticle illumination intensity; counter-clockwise rotation decreases intensity.

c. **Bullet Trap.** The bullet trap assembly (figure 4-5) is a special tool used to prevent injury to personnel or damage to material through accidental firing of machine gun M134. It is a steel cylinder, closed at one end, which contains a deflector designed to contain and dissipate the energy of a bullet inadvertently fire. The bullet trap assembly fits over the gun barrels and is secured in place by two quick release pins.

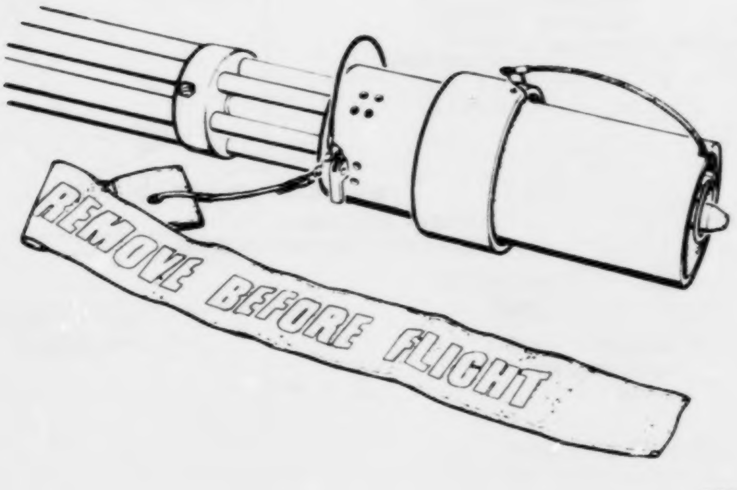


Figure 4-5. Bullet Trap Assembly

4-5. PREFLIGHT CHECKS.

a. Exterior.

WARNING

Copilot door must remain installed and closed during firing of the weapon. Armament system will fire when door is open. Ensure latch assembly has been properly adjusted and door striker has been properly shimmed. Door will not rattle when properly adjusted.

WARNING

A firing pin may be cocked and ready to be released. Before removing safing sector and housing cover, rotate barrels clockwise (opposite firing direction) slightly to prevent firing.

(1) Gun safing sector — Open.

(2) Bullet trap assembly — Installed and pinned.

(3) Gun installed and secured. Check that front mount handle is in LOCKED position and rear mount is secure.

(4) Clear gun — Standing behind the gun facing forward.

(a) Ensure no personnel are in front of gun and gun is pointed toward safe area.

(b) Rotate barrels clockwise one barrel position (or opposite direction of rotation when viewed from breech end).

(c) Remove safing sector and housing cover.

(d) Rotate barrels counterclockwise to visually check each chamber and remove any cartridges. Press gun timing pin and rotate to timing position.

(5) Check each bolt for lubrication and freedom of movement.

(6) Install safing sector and housing cover.

(7) Remove bullet trap assembly.

(8) Electrical connections — Check for security and generation condition.

(9) Clearing guide — Check freedom of movement.

(10) Chuting — Check for secure attachment and general condition.

(11) Delinking feeder — Check timing to gun pressing timing pins.

(12) Ram Air Duct — Check for condition and security of attachment.

(13) Ammunition container — Loaded ammunition belt engaged in delinking feeder.

(14) Gun elevation — Depress to point below door sill.

b. **Cabin Check.**

(1) Ammunition box — Check cover secure, and that ammunition container secure.

(2) Sight linkage — Check security and general condition.

(3) Mounting points — Check security.

(4) Downstop — Installed and secure.

4-6. COCKPIT PREFIRE CHECK.

1. ARMT PWR and ARMT circuit breakers — Depressed.
2. MASTER switch — OFF.
3. ARMED-SAFE switch — SAFE.
4. BAT switch — BAT.
5. Sight Filament Selector switch — Rear (spare filament).
6. MASTER switch — FIRE/NORM.

WARNING

Do not move ARMED-SAFE switch to ARMED during following checks.

7. Reflex sight — Adjust height note reticle and lock.

8. Reticle Illumination Knob — Desired intensity.

9. Sight Filament Selector switch — Forward (primary filament) and check that reticle is visible.

10. MASTER switch — OFF.

11. Sight Elevation Control Knob — Set to expected target range.

12. Elevation/Depression switch — Check full travel of gun.

13. Reflex sight — Move to stowed position if desired.

4-7. BEFORE TAKEOFF.

1. ARMED-SAFE switch — SAFE.

2. MASTER switch — OFF.

4-8. BEFORE FIRING.

CAUTION

Do not attempt to fire the gun system if the bullet trap assembly has not been removed. Gun can be damaged.

1. Reflex sight — Position for use.

2. Sight Elevation Control Knob — Reset distance as required.

3. MASTER switch — FIRE NORM or FIRE TO CLEAR.

CAUTION

Repeated firing of full 3-second bursts in the FIRE NORM mode increases possibility of ammunition "cook off" and gun jamming.

4. Reticle Illumination Knob — Reset intensity if required.

5. ARMED-SAFE switch — ARMED.

6. Gun Elevation/Depression switch — As required.

4-9. FIRING.

1. Helicopter — Maneuver as required to position reticle pattern on target.

WARNING

Normal firing should be accomplished in short bursts or as controlled by the 3-second burst limiter. If combat emergency requires expending a full complement of ammunition (2,000 rounds) by continued re-cycling of the burst limiter, a minimum of 15 minutes cooling time must be observed before resuming fire after reloading. Barrel life is limited to 40,000 rounds when the 15 minute cooling period between 2000 round loads is not observed.

2. Trigger switch — Lift guard and pull trigger to low or high firing rate position as desired.

4-10. AFTER FIRING.

1. MASTER switch — FIRE TO CLEAR.

WARNING

Select a safe area to direct the clearing burst before pulling trigger.

2. Trigger switch — Lift guard and momentarily pull trigger to low or high firing rate position to complete clearing cycle. Selection of low rate will conserve ammunition.

3. GUN NOT CLEARED light — Out.

4. ARMED-SAFE switch — SAFE.

5. MASTER switch — OFF.

6. Gun Elevation/Depression switch — Depress to point gun below door sill level.

7. Reflex sight — Stowed position.

4-11. BEFORE LANDING.

1. ARMED-SAFE switch — SAFE.

2. MASTER switch — OFF.

4-12. BEFORE LEAVING HELICOPTER.

a. Verify that control switch and lights are in the specified position or conditions as follows:

(1) GUN NOT CLEARED light — Out.

(2) ARMED-SAFE switch — SAFE.

(3) ARMED light — Out.

(4) MASTER switch — OFF.

(5) Reflex sight — Stowed position.

WARNING

A firing pin may be cocked and ready to be released. Before removing safing sector and housing cover, rotate barrels clockwise (opposite firing direction) slightly to prevent firing.

(6) Gun safing sector — Open.

(7) Bullet trap assembly — Installed.

b. Release ammunition chute from delinking feeder and remove one cartridge from the linked cartridge.

c. Manually rotate barrels counterclockwise, viewed from breech end (firing direction), until remaining cartridges are cleared from delinking feeder and the gun.

d. Open cover on ammunition container assembly and pull linked ammunition from chutes and into ammunition container assembly. Remove ammunition container assembly if required.

4-13. AMMO LOADING.

a. Prior to loading the gun, check to be sure the following conditions exist:

(1) BAT and GEN switches — OFF.

(2) Armament MASTER switch — OFF.

(3) ARMED-SAFE switch — SAFE.

b. Install bullet trap assembly.

c. Fold ammunition belt into ammunition container assembly and work it through ammunition chutes to the delinking feeder.

d. Remove safing sector and housing cover of gun.

e. Feed ammunition into delinking feeder by working through open top of ammunition chute.

f. Rotate gun barrel counterclockwise (as viewed from rear of gun) until a round drops from the delinking feeder.

g. Install safing sector and housing cover on gun. Close and latch ammunition container assembly cover.

h. Remove bullet trap assembly as required.

CHAPTER 5

OPERATING LIMITS AND RESTRICTIONS

SECTION I. GENERAL

5-1. PURPOSE.

This chapter includes all important operating limits and restrictions that must be observed during ground and flight operations.

5-2. GENERAL.

The operating limitations set forth in this chapter are the direct results of design analysis, tests, and operating experiences. Compliance with these limits will allow the pilot to safely perform the assigned missions and to derive maximum utility from the helicopter.

5-3. EXCEEDING OPERATIONAL LIMITS.

Anytime an operational limit is exceeded an appropriate entry shall be made on DA Form 2408-13. Entry shall state what limit or limits were exceeded, range, time beyond limits, and any additional data that would aid maintenance personnel in the inspection that is required.

5-4. MINIMUM CREW REQUIREMENTS.

The minimum crew requirement consists of only the pilot, whose station is at the right side of the aircraft. Additional crewmembers as required will be added at the discretion of the commander, in accordance with pertinent Department of the Army regulations.

SECTION II. SYSTEMS LIMITS

5-5. INSTRUMENT MARKINGS.

The operating ranges for both the helicopter and engine are listed below and shown on figure 5-1 and figure 5-2.

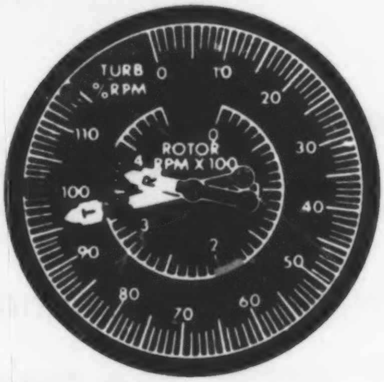
a. **Operating Limitations and Ranges.** Operating limitations and ranges are illustrated by the colored markings which appear on the dial faces of engine, flight, and utility system instruments. Red markings on the dial faces of these instruments indicate the limit above or below which continued operation is likely to cause damage or shorten life. The green markings on instruments indicate the safe or normal range of operation. The yellow markings on instruments indicate the range when special attention should be given to the operation covered by the instrument. Operation is permissible in the yellow range, but is time limited. The blue markings on instruments indicate recommended maximum IAS for autorotation. (Green areas will have a single line and yellow areas two yellow lines. This is for identification under night lighting conditions or when using night vision goggles **C**).

b. **A Limitation Markings.** Limitation markings consist of strips of semi-transparent color tape which adhere to the glass outside of an indicator dial. All round instruments that have range markings on glass face must also have a white slippage mark between glass and frame. All other limitation markings are painted on dial faces under glasses. The maximum and minimum markings are half red and half white as indicated in figure 5-1, with the red portion of the marking farthest from the limitation.

c. **C Limitation Markings.** The instrument markings containing the saw tooth red line (VVV) is placed on the dial face with respect to the operating limit as shown in figure 5-2. The saw tooth edge of the red lines cautions the pilot that he is approaching a

FUEL GRADE JP-4 OR JP-5

■ □ ■ ■


TURB %RPM
ROTOR RPM X 100
T
R
0
10
20
30
40
50
60
70
80
90
100
110
0
4
3
2

POWER TURBINE TACHOMETER

■ 101% Minimum

■ 101% to 103% Continuous Operation

■ 103% Maximum

● Above 103% to 114% transient, 15 seconds maximum Record N2 torque and duration when limit is exceeded

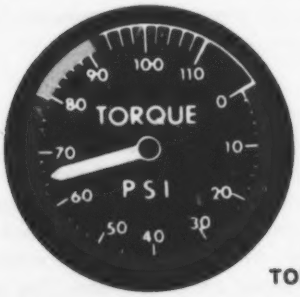
ROTOR TACHOMETER

■ 330 RPM Minimum

■ 330 to 390 Continuous Operation (Including Autorotation)

■ 390 RPM Maximum

□ 172 to 206 RPM Avoid Prolonged Operation

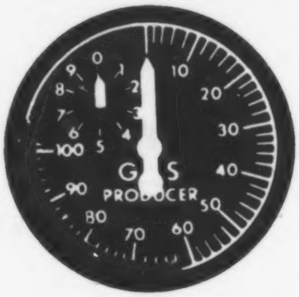

TORQUE
PSI
0
10
20
30
40
50
60
70
80
90
100
110

TORQUEMETER

■ 0 to 79 PSI Continuous Operation

□ Above 79 to 92 PSI 5 Minute Operation

■ 92 PSI Maximum

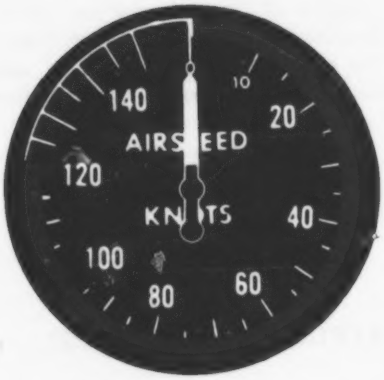

GAS PRODUCER
0
10
20
30
40
50
60
70
80
90
100
1
2
3
4
5
6
7
8
9

GAS PRODUCER TACHOMETER

■ 62 to 104%

■ 104% Maximum

Above 104% to 105% Transient, 15 seconds maximum


AIRSPEED
KNOTS
0
10
20
40
60
80
100
120
140

AIRSPEED

■ 0 to 120 Knots

■ 120 Knots IAS Maximum

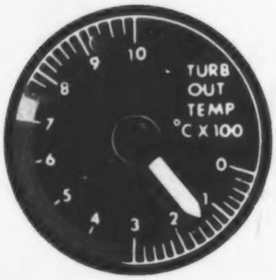
■ 100 Knots Recommended Maximum IAS for Autorotation

Refer to Figure 5-3 for Additional Informatin (Airspeed Limits Chart).

■ ■ □ ■

206900-513-1

Figure 5-1. Instrument Markings A (Sheet 1 of 2)



TURBINE OUTLET TEMPERATURE

STARTING

0°C to 749°C Normal

Above 749°C to 927°C Maximum 10 Seconds

● 927°C Maximum

CONTINUOUS OPERATION

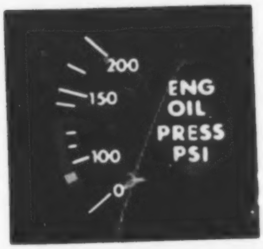
330°C Minimum

▬ 330°C to 693°C Normal Operation

▬ Above 693°C to 749°C (30 Minute Limit)

▬ 749°C Maximum

Above 749°C to 843°C During Power Transient, 6 Seconds Maximum. Not to be Used Intentionally.



ENGINE OIL PRESSURE

▬ 50 PSI Minimum

CAUTION

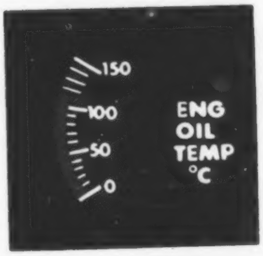
Disregard yellow and green instrument markings for engine oil pressure.

▬	Idle to 78% N1	50 to 130 PSI
	Above 78% to 89% N1	90 to 130 PSI
	Above 89% N1	115 to 130 PSI

▬ 130 PSI Maximum

NOTE

During Cold Weather Start, Maximum May Go to 150 PSI, But You Must Remain at Engine Idle Position Until Normal Limits are Attained.



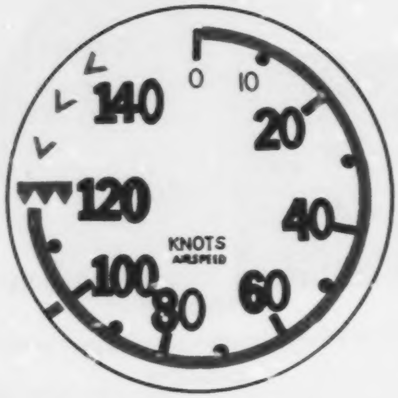
ENGINE OIL TEMPERATURE

▬ 0°C to 107°C Continuous Operation

▬ 107°C Maximum

206900-513-2

Figure 5-1. Instrument Markings A (Sheet 2 of 2)

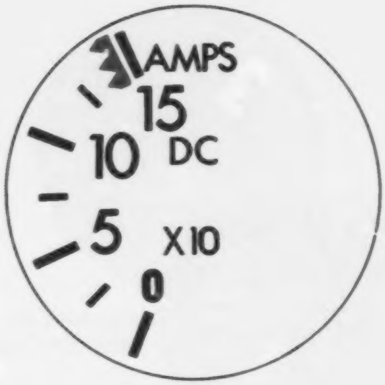

0
10
20
40
60
80
100
120
140
KNOTS
AIRSPEED

AIRSPEED

▬ 0 to 120 Knots Continuous Operation

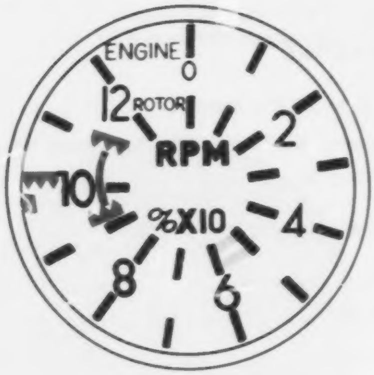
▼▼▼ 120 Knots Maximum
Refer to figure 5-3 for additional information (AIRSPEED LIMITS).

▬ 100 Knots Recommended Maximum for Autorotation


AMPS
15
10
DC
5
X10
0

AMMETER

▼▼▼ This limit mark not applicable.


ENGINE
0
12
ROTOR
2
RPM
10
%X10
4
8
6

ROTOR TACHOMETER

▬ 93 to 110 Percent Continuous Operation

▬ 49 to 58 Percent Continuous Operation Prohibited

▲▲▲ 93 Percent Minimum

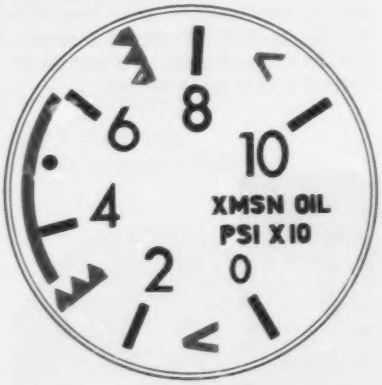
▼▼▼ 110 Percent Maximum

ENGINE TACHOMETER

▬ 98 to 100 Percent Continuous Operation

▼▼▼ 100 Percent Maximum

15 Second Maximum Transient N2 Limit is 110% (Autorotation)


6
8
10
4
XMSN OIL
PSI X10
2
0

TRANSMISSION OIL PRESSURE

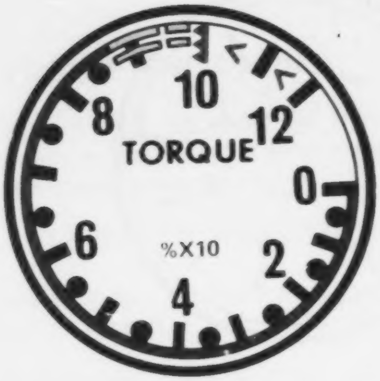
▬ 30 to 60 PSI Continuous Operation

▲▲▲ 30 PSI Minimum

▼▼▼ 70 PSI Maximum

206075-272-1

Figure 5-2. Instrument Markings **C** (Sheet 1 of 3)

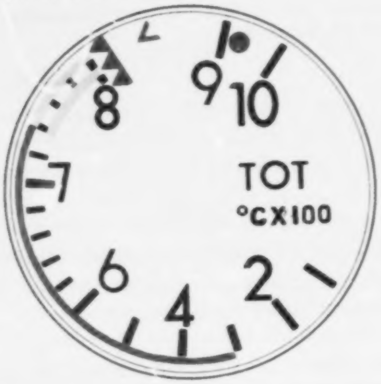


TORQUEMETER

■ 0 to 85 Percent Continuous Operation

□ 85 to 100 Percent 5 Minute Operation

▼▼▼ 100 Percent Maximum



TURBINE OUTLET TEMPERATURE INDICATOR

STARTING

0°C to 810°C Normal

Above 810°C to 927°C Maximum 10 Seconds

● 927°C Maximum 1 Second

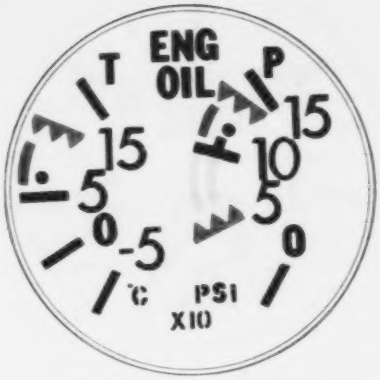
CONTINUOUS OPERATION

300°C Minimum

■ 300°C to 738°C Continuous Operation

□ Above 738°C to 810°C 30 Minute Limit

▼▼▼ 810°C Maximum. Above 810°C to 843°C during power transient, 6 seconds maximum.



ENGINE OIL PRESSURE

▲▲▲ 50 PSI MINIMUM

□ CAUTION

DISREGARD yellow and green instrument markings for engine oil pressure.

■ Idle to 78%N1	50-130 PSI
Above 78% to 89%N1	90-130 PSI
Above 89%N1	115-130 PSI

▼▼▼ 130 PSI MAXIMUM

NOTE

During cold weather start, maximum may go to 150 PSI, but you must remain at engine idle position until normal limits are attained

ENGINE OIL TEMPERATURE

■ 0°C to 107°C Continuous Operation

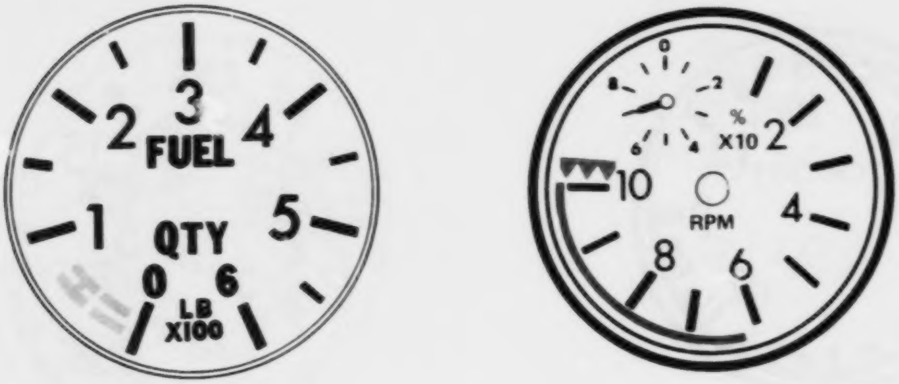
▼▼▼ 107°C Maximum

NOTE

During cold weather operation the engine may be operated at engine oil temperature down to -50°C.

206075-272-2

Figure 5-2. Instrument Markings C (Sheet 2 of 3)



FUEL QUANTITY

▨ 0 to 65 Low Fuel

GAS PRODUCER TACHOMETER INDICATOR

▼▼▼ 105 Percent Maximum

■ 62 to 105 Percent Continuous Operation

Above 105 to 106 Percent Permissible for 15 Seconds

206075-272-3

Figure 5-2. Instrument Markings **C** (Sheet 3 of 3)

limit as shown in figure 5-2. A white dot on the face of the instrument indicates the safe or normal range of operation. A chevron (<) indicates above or below operating limits and to go in direction of point.

5-6. TRANSMISSION OIL TEMPERATURE LIMITS.

Warning light on.

5-7. TRANSMISSION OIL PRESSURE LIMITS.

Warning light on.

C Refer to figure 5-2 for transmission oil pressure limits.

5-8. WIND LIMITATIONS.

a. The helicopter can be started in a maximum wind velocity of 45 knots and a maximum gust spread of 15 knots.

NOTE

Gust spreads are not normally reported. To obtain spread, compare minimum and maximum wind velocities.

b. Maximum wind for hovering is 35 knots crosswind and 30 knots tailwind.

c. Maximum wind for mooring is 65 knots parallel to the ground in any direction.

5-9. **A** FIRING LIMITATIONS.

WARNING

Copilot door must remain closed during firing of weapons.

Barrel life is limited to 40,000 rounds when the 15 minute cooling period between 2000 round loads is not observed.

5-10. TOWING LIMITATIONS.

The maximum gross weight for towing the helicopter is 3000 pounds on prepared or unprepared surfaces.

SECTION III. POWER LIMITS

5-11. ENGINE LIMITATIONS.

Refer to figure 5-1 A, figure 5-2 C. If N2 limit is exceeded, entry on DA Form 2408-13 must include duration and torque indication.

5-12. FUEL OPERATION LIMITS.

a. **Standard Fuel.** No restrictions are imposed when JP-4 fuel is used.

b. **Alternate Fuel.** JP-5, JP-8, Jet A and Jet A-1 are restricted to an ambient temperature range of -18°C to +52°C. A deceleration check must be performed prior to the first flight of each day. If autorotations are to be performed a deceleration check will be done prior to each flight. Refer to paragraph 8-18.

NOTE

Engine starting difficulties may be encountered if alternate fuels are used at ambient temperatures below +5°C (39°F).

c. **Emergency Fuel Aviation Gasoline (MIL-G-5572) without Tricreasyl Phosphate (TCP).**

(1) The helicopter shall not be flown when emergency fuel has been used for a total accumulated time of 6 hours. Entry on remarks section of DA Form 2408-13 is required for each time emergency fuel is used.

(2) Practice autorotation is prohibited using emergency fuel.

5-13. STARTER LIMITS.

a. **Starter Engage Time** — If rise in TOT does not occur during the first 20 seconds, starter engage is limited to the following total times:

EXTERNAL POWER	BAT POWER
25 seconds ON	40 seconds ON
30 seconds OFF	60 seconds OFF
25 seconds ON	40 seconds ON
30 seconds OFF	60 seconds OFF
25 seconds ON	40 seconds ON
30 minutes OFF	30 minutes OFF

b. **Starter Engage Time** — If rise in TOT occurs during the first 20 seconds, starter engage time is limited to the following total times:

EXTERNAL/BAT POWER

1 minute ON
1 minute OFF
1 minute ON
1 minute OFF
1 minute ON
30 minutes OFF

5-14. ENGINE STARTING LIMITATIONS.

During starting if N1 does not reach 58 percent in a total time of 45 seconds (or 60 seconds below 10°C FAT), close throttle and press starter switch until TOT is below 200°C. If engine fails to start on third attempt, abort start and make an entry on DA Form 2408-13. Starter engage time limits in paragraph 5-13 a. and b. above do not apply to engine starting limitations should abort start procedures become necessary.

5-15. HEALTH INDICATOR TEST (HIT).

The HIT is the method by which the aviator in day-to-day flying monitors the aircraft engine condition. This is accomplished by the aviator selecting a N1 speed (%) predicted upon the existing FAT. The TOT must then be compared to a predicted value (Baseline TOT) within a certain tolerance. TOT variation from baseline values are logged by the aviator. This log is a part of the aircraft records and is an aid to the maintenance personnel in monitoring performance trends and in troubleshooting on the engine. When the difference between the recorded TOT and the baseline TOT is ±20°C or greater, an entry on DA Form 2408-13 will be made to notify maintenance. A difference of ±30°C A, ±40°C C or greater is cause for grounding the aircraft.

5-16. HOVERING LIMITATIONS.

Refer to paragraph 5-24.

SECTION IV. LOAD LIMITS

5-17. CENTER OF GRAVITY LIMITATIONS.

Maintain the aircraft within the limits in the center of gravity limitation charts in Chapter 6.

5-18. WEIGHT LIMITATIONS.

3000 pounds maximum gross weight A , (3200 pounds maximum gross weight C).

SECTION V. AIRSPEED LIMITS

5-19. AIRSPEED LIMITS.

a. Refer to airspeed operating limits chart (figure 5-3) for forward airspeed limits.

b. Sideward flight limits are 35 knots.

c. Rearward flight limits are 30 knots.

d. Recommend maximum indicated airspeed for autorotation is 100 knots.

e. Maximum indicated air speed with any door removed is 100 knots.

5-20. COCKPIT AND CABIN DOOR RESTRICTIONS.

a. Helicopter will not be flown without cabin doors unless heavy duty rear electronics compartment soundproof blanket (P/N 206-070-893-7), or its approved equivalent, has been installed. Helicopter will not be flown with only one cockpit door or one cabin door removed.

b. Whenever any OH-58A/C helicopter is operated without its cabin doors:

(1) All soundproof blankets must be in serviceable condition and firmly attached. Pilot must verify.

(2) If the rear cushions (bottom and back) are modified per MWO 55-1520-228-30-30, they may remain installed provided seat belts and shoulder harnesses are installed, properly fastened and tightened.

(3) Loose equipment or components must be removed or secured.

c. Doors shall not be opened in flight.

5-21. A FLIGHT RESTRICTION WITH FLOAT LANDING GEAR INSTALLED.

a. Airsped Limit. Float Landing Gear Installed — Rearward and sideward airspeed limit is 30 knots. Figure 5-3.

b. Altitude Limitation.

(1) Maximum operating — 15,000 feet altitude.

(2) Flight to lower altitude — Increase pressure 0.5 PSI per 1000 feet below base altitude, to minimum operating altitude.

(3) Flight to higher altitude — Limit climbing flight to 8000 feet differential pressure altitude. Above 8000 feet differential pressure altitude, reduce float pressure 0.5 PSI per 1000 feet.

AIRSPEED OPERATING LIMITS

AIRSPEED OPERATING LIMITS
OH-58A/C
T63-A-700 A
T63-A-720 C

EXAMPLE

WANTED

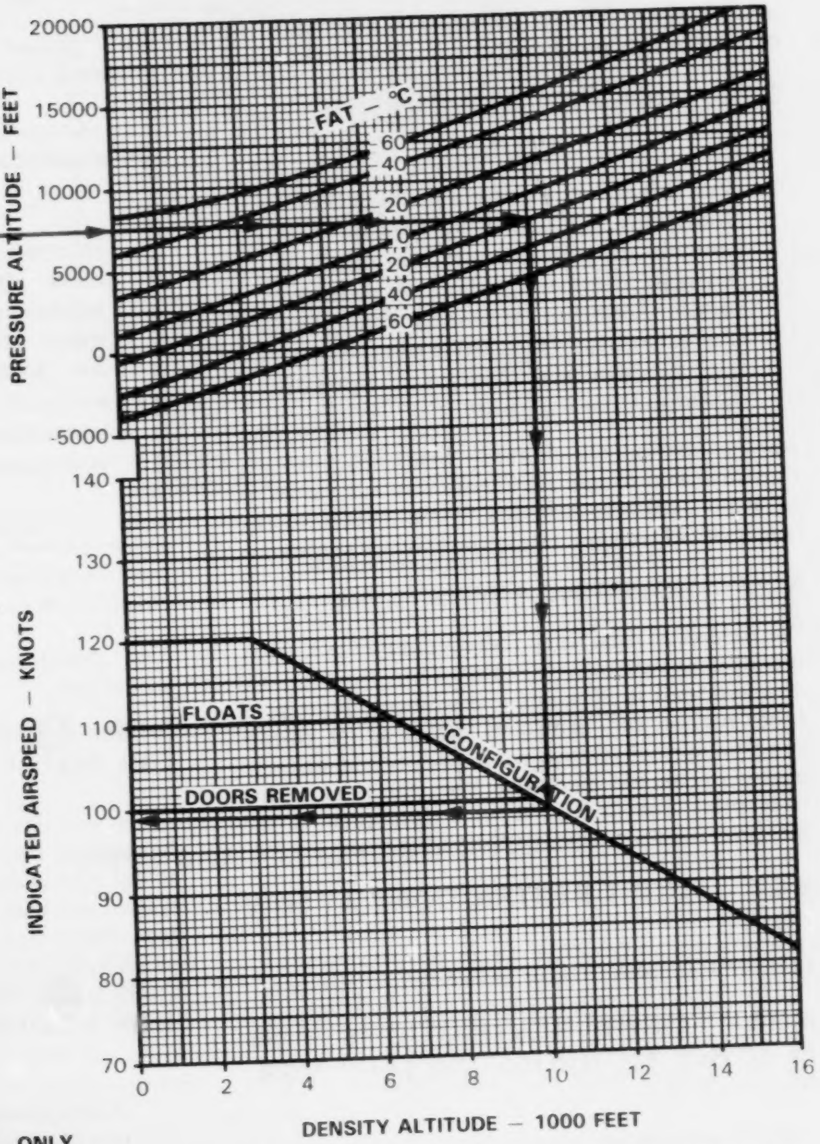
MAXIMUM INDICATED AIRSPEED

KNOWN

PRESSURE ALTITUDE = 7500 FEET
FAT = +20°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CONFIGURATION. SEE NOTE
MOVE LEFT, READ MAXIMUM INDICATED AIRSPEED = 99 KNOTS



NOTE
FLOATS CONFIGURATION IS A ONLY.

DATA BASIS: DERIVED FROM BELL HELICOPTER TEXTRON FLIGHT TEST

206099-32

Figure 5-3. Airspeed Operating Limits Chart

SECTION VI. MANEUVERING

5-22. AEROBATIC MANEUVERS.

Aerobatic maneuvers are prohibited. Aerobatic flight is defined to be any intentional maneuver involving an abrupt change in aircraft attitude, an abnormal attitude, pitch angle greater than ±30° or roll angles greater than 60°, or abnormal acceleration not necessary for normal flight.

5-23. CONTROL MOVEMENTS.

CAUTION

For gross weights greater than 3000 lbs and density altitudes greater than sea level, the directional control margin may be significantly reduced while hovering in winds from the right greater than 20 knots or for right sideward flight at speeds greater than 20 knots.

Abrupt control movements, including rapid and repetitive anti-torque pedal reversals are prohibited to avoid excessive stresses in the structure. This restriction in no way limits normal control application.

5-24. HOVERING LIMITATIONS.

Ten percent of total pedal travel, full right to full left, is considered adequate for safe control. The rearward airspeed limit is 30 knots and sideward limit is 35 knots except that control is marginal for certain combinations of relative wind velocity and azimuth angles (measured clockwise from the nose of the helicopter). See Chapter 8 for a description of the marginal wind velocity and azimuth angles.

5-25. FLIGHT RESTRICTIONS AT LOW "G'S".

Flight at less than +0.5g is prohibited.

5-26. FLIGHT RESTRICTIONS FOR PRACTICE AUTOROTATION LANDINGS. (Figure 5-4.)

Practice autorotation landings may be accomplished subject to the following limitations.

a. A qualified OH-58A/C IP must be in position to take control of the aircraft.

b. Reported surface winds must not exceed 20 knots.

c. Surface crosswind component must not exceed 10 knots. Wind gust spread must not exceed 10 knots.

d. Touchdown rotor RPM must not be less than 225 RPM A, 64% C.

e. Ground speed at touchdown should be approximately 5 knots.

f. Airspeed during glide shall not be less than that established for minimum rate of descent.

CAUTION

In any event, relatively long ground runs with the collective up, or any tendency to float for long distance prior to skid contact should be avoided. If vibrations are encountered after touchdown immediate lowering of the collective is recommended.

g. Upon ground contact, collective pitch must be reduced smoothly to bottom stop without delay while maintaining cyclic pitch near center position. Application of aft cyclic should be avoided.

h. Touchdown autorotations downwind are prohibited.

5-27. C FLIGHT RESTRICTION OF TAIL ROTOR CONTROL.

Helicopter will not be flown unless the Primary Directional Anti-Torque System and the Vulnerability Reduction (backup) Directional Anti-Torque system are both operable. This restriction does not apply after compliance with MWO 55-1520-228-50-30.

5-28. C FLIGHT RESTRICTION FOR HIGH POWER.

NOTE

In aircraft equipped with IR exhaust stacks, rate of climb in excess of 1000 ft/min may result in divergent aircraft pitch oscillation which can reach 20 to 30 degree attitudes. This divergence can be alleviated by either increasing airspeed during steady climbs or decreasing rate of climb. Climb rates in excess of 1000 ft/min should be avoided.

EXAMPLE

WANTED

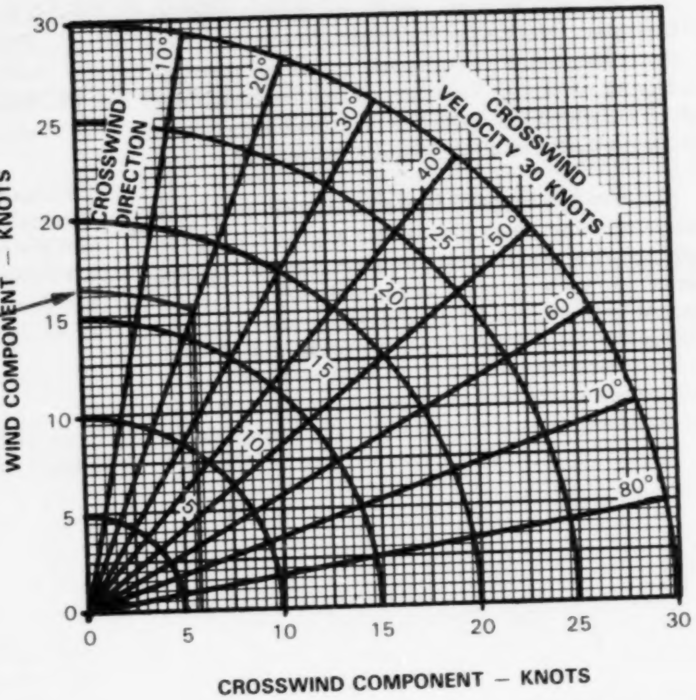
CROSSWIND COMPONENT

KNOWN

WIND VELOCITY = 17 KNOTS
CROSSWIND DIRECTION (RELATIVE TO TOUCHDOWN HEADING) = 20°

METHOD

ENTER WIND VELOCITY HERE FOLLOW 17 KNOTS CURVE TO CROSSWIND DIRECTION. FROM THAT POINT MOVE DOWN, READ CROSSWIND COMPONENT = 6 KNOTS



206099-33

Figure 5-4. Practice Autorotation Landing Limits Crosswind Components

SECTION VII. ENVIRONMENTAL RESTRICTIONS

5-29. FLIGHT UNDER INSTRUMENT METEOROLOGICAL CONDITIONS (IMC).

This aircraft is restricted to visual flight conditions. Flight into instrument meteorological conditions will be conducted on an emergency basis only.

5-30. FLIGHT RESTRICTIONS IN FALLING OR BLOWING SNOW.

Flight in falling or blowing snow is prohibited except for those helicopters with the reverse flow inlet fairing installed. Helicopters having the above features may be flown in falling or blowing snow provided reverse flow inlet fairings are installed and the following criteria is met.

a. Visibility reduced by snow must be at least 1/2 mile.

b. Prior to initial takeoff and each subsequent takeoff, inspect the helicopter as follows:

(1) Inspect inlet for possible accumulations of snow, slush, or ice. Accumulations must be removed

from the interior of the reverse flow inlet (hand removal is acceptable).

(2) Inspect the engine plenum chamber through the plexiglass windows (a flashlight may be required) on each side of the inlet cowling for snow, slush, or ice, paying particular attention to the firewalls, rear face of the particular separator, bottom corners, and protruding surfaces such as guide vanes, etc.

(3) Visually inspect the plastic particle separator eductor tubes on each side of the engine fairing for obstructions and snow. A thin film of ice about the interior of each tube is acceptable. External ice adjacent to the eductor tubes is acceptable.

5-31. FLIGHT OVER SALT WATER.

CAUTION

Prolonged hovering over salt water which results in spray ingestion, indicated by spray on the windshield, should be avoided.

Salt spray ingestion in turbine engines may result in a deterioration in performance as well as a loss in compressor stall margin. When operating within 10 miles of salt water or within 200 miles of volcanic activity appropriate entries should be made on DA Form 2408-13 to alert maintenance.

CHAPTER 6

WEIGHT/BALANCE AND LOADING

SECTION I. GENERAL

6-1. GENERAL.

Chapter 6 contains sufficient instructions and data so that an aviator knowing the basic weight and moment of the helicopter can compute any combination of weight and balance.

6-2. CLASSIFICATION OF HELICOPTER.

Army Model OH-58A/C is in Class 2. Additional directives governing weight and balance of Class 2 aircraft forms and records are contained in AR 95-16, TM 55-1500-342-23, and DA PAM 738-751.

6-3. HELICOPTER STATION DIAGRAM.

Figure 6-1 shows the helicopter reference datum lines, fuselage stations, buttlines and waterlines. The primary purpose of the figure is to aid personnel in the computation of helicopter weight/balance and loading.

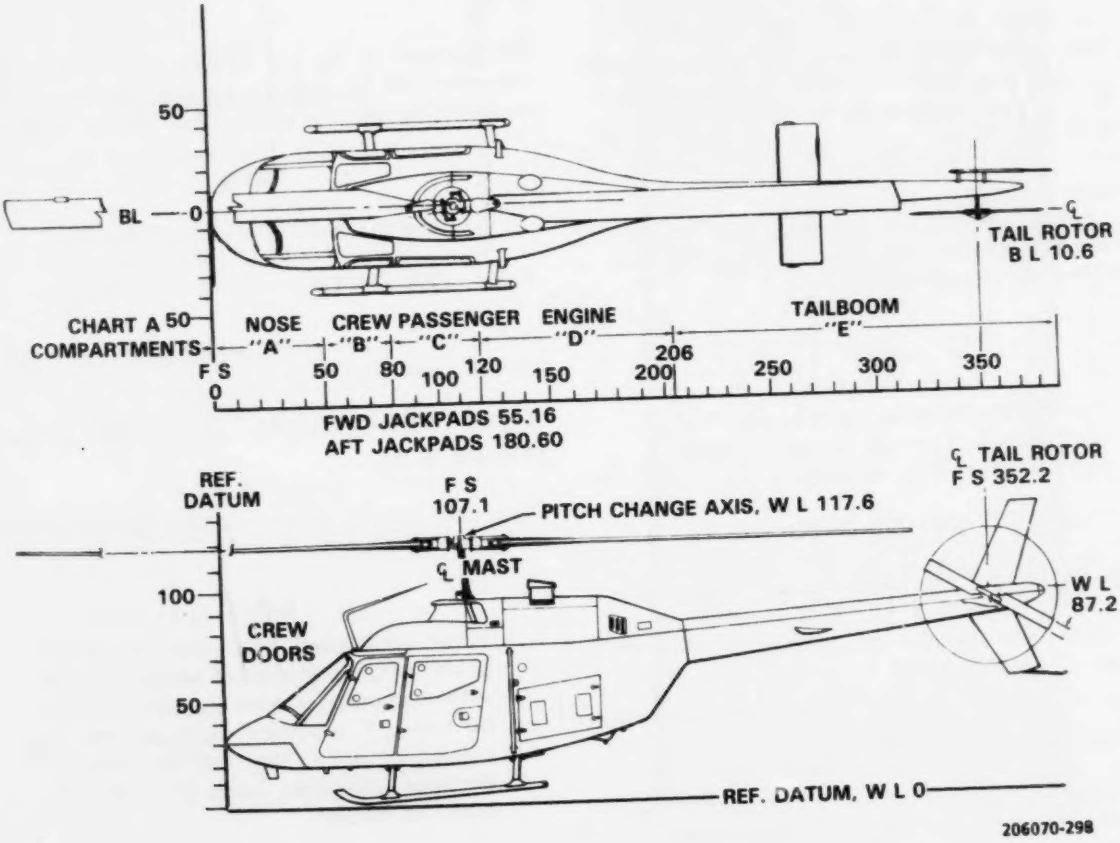

50
BL
0
50
TAIL ROTOR
B L 10.6
CHART A
COMPARTMENTS
NOSE
"A"
CREW
"B"
PASSENGER
"C"
ENGINE
"D"
TAILBOOM
"E"
206
F S
0
50
80
100
120
150
200
250
300
350
FWD JACKPADS 55.16
AFT JACKPADS 180.60
REF.
DATUM
F S
107.1
PITCH CHANGE AXIS, W L 117.6
℄ TAIL ROTOR
F S 352.2
℄ MAST
100
CREW
DOORS
50
W L
87.2
REF. DATUM, W L 0
206070-298

Figure 6-1. Helicopter Station Diagram

6-4. LOADING CHARTS.

a. Information. The loading data contained in this chapter is intended to provide information necessary to work a loading problem for the helicopters to which this manual is applicable.

b. Use. From the figures contained in this chapter, weight and moment are obtained for all variable load items and are added to the current basic weight and moment (DD Form 365-3) to obtain the gross weight and moment.

6-5. CENTER OF GRAVITY LIMIT CHART (Figure 6-2).

a. The gross weight and moment are checked on figure 6-2 to determine the approximate center of gravity (cg).

b. The effect on cg by the expenditures in flight of such items as fuel, amunition **A**, etc., may be checked by subtracting the weights and moments of such items from the takeoff weight and moment and checking the new weight and moment on the center of gravity limit chart.

c. If the weight and moment lines intersect between the forward and aft limit lines, the helicopter is within flight limits.

NOTE

This check should be made to determine whether or not the cg will remain within limits during the entire flight.

6-6. CARGO SPACE (Figure 6-3).

The cargo space chart provides the information necessary to ensure that the maximum cargo weight does not exceed the amount specified for different helicopter configurations.

NOTE

Cargo space chart is used in conjunction with figure 6-1 and figure 6-2 to compute parameters of the loading charts contained in this chapter.

6-7. CARGO PLATFORM.

CAUTION

To prevent damage to the floor of the cabin, no cargo will be placed on the floor of the helicopter. The cargo platform will be installed whenever cargo is to be carried.

The cargo platform will be installed in the cabin for cargo handling. The platform is a two-piece construction of plywood sheeting. Provisions are made for mounting to existing fuselage hardware. The strength of the cargo tiedowns on the cargo platform is 2100 pounds.

6-8. FUEL LOADING CHART (Figure 6-4).

The purpose of the fuel loading chart is to provide moment/100 for varying quantity (gallons and/or weight in pounds) for either JP-4, JP-5, or JP-8 fuel.

NOTE

Auxiliary tank is in passenger area.

6-9. OIL DATA.

For weight and balance purposes, engine oil is part of aircraft basic weight.

6-10. PERSONNEL LOADING (Figure (Figure 6-5).

Refer to figure 6-5, to compute pilot, copilot/observer and passenger moments.

NOTE

When helicopter is operated at critical gross weights, the exact weight of each individual occupant plus equipment should be used. If weighing facilities are not available, or if the tactical situation dectates otherwise, loads shall be computed as follows.

a. Combat equipped soldiers; 240 lbs. per individual.

C.G.
CHART

CENTER OF GRAVITY LIMITS

EXAMPLE

WANTED

DETERMINE APPROXIMATE CENTER OF GRAVITY FOR KNOWN WEIGHT AND MOMENT

KNOWN

GROSS WEIGHT = 2850 POUNDS
MOMENT/100 = 3150 INCH POUNDS

METHOD

MOVE RIGHT FROM 2850 POUNDS TO 3150 IN-LB DIAGONAL LINE. FROM THIS POINT MOVE DOWN TO READ 110.5 ON CENTER OF GRAVITY SCALE

NOTE

FORWARD C.G. LIMITS:

1. UP TO 2500 lb G.W., FWD LIMIT IS STA. 105.2.

2. FROM 2500 lb G.W. TO 3000 lb G.W., THE FWD LIMIT MOVES AFT LINEARLY FROM STA. 105.2 TO STA. 106.0

C 3. FROM 3000 lb G.W. TO 3200 lb G.W., THE FWD LIMIT MOVES AFT LINEARLY FROM STA. 106.0 TO STA. 107.0

AFT C.G. LIMITS:

1. UP TO 2500 lb G.W., AFT LIMIT IS STA. 114.2

2. FROM 2500 lb G.W. TO 3000 lb G.W., THE AFT LIMIT MOVES FWD LINEARLY FROM STA. 114.2 TO STA. 112.2

C 3. FROM 3000 lb G.W. TO 3200 lb G.W., THE AFT LIMIT MOVES FWD LINEARLY FROM STA. 112.2 TO STA. 111.4

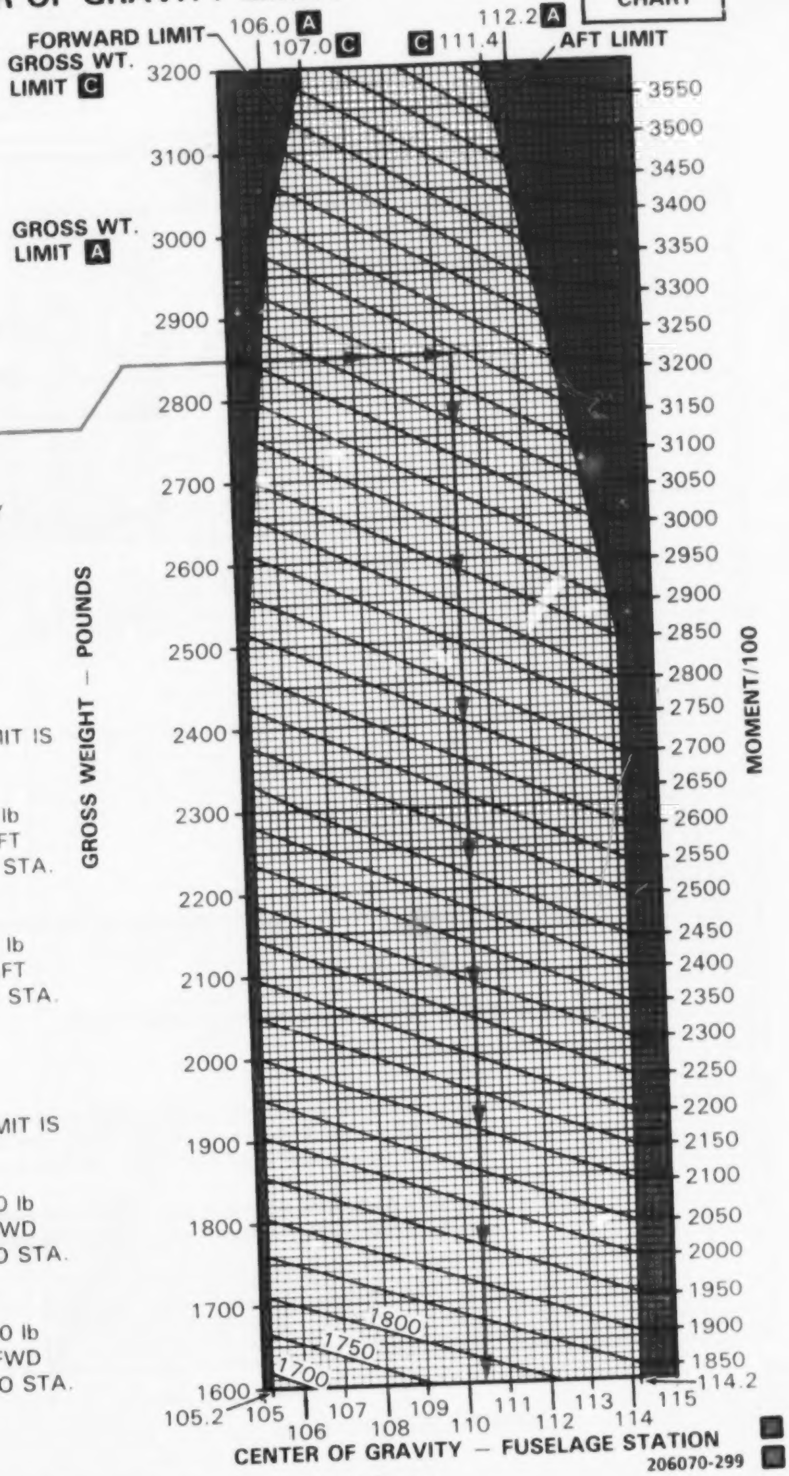
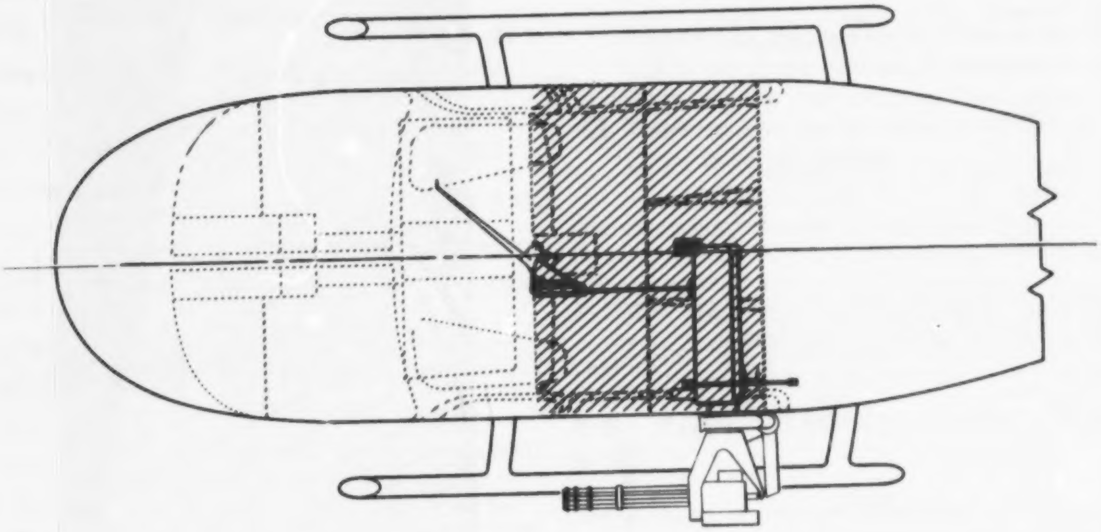


Figure 6-2. Center of Gravity Limit Chart



VIEW LOOKING DOWN

▨ Total maximum cargo weight is 950 pounds not exceeding 100 pounds per sq. ft.

CAUTION

No cargo shall be carried in the avionics compartment.

Maximum single box cargo size, unarmed configuration, is 33.0 x 23.4 x 44.0 inches. Maximum cargo size either side of canted center post is 33.0 x 27.5 x 18.5 inches.

The M27 armament system weight shall be included in the maximum allowable cargo weight when installed **A** .

206099-34

Figure 6-3. Cargo Space

EXAMPLE

WANTED

MOMENT FOR KNOWN FUEL QUANTITY

KNOWN

QUANTITY-50 GALLONS (325LBS JP-4)

METHOD

MOVE RIGHT FROM 325 LBS ON JP-4 SCALE TO INTERSECT JP-4 DIAGONAL CURVE.

MOVE DOWN FROM THE POINT TO READ 370 ON THE MOMENT/100 SCALE

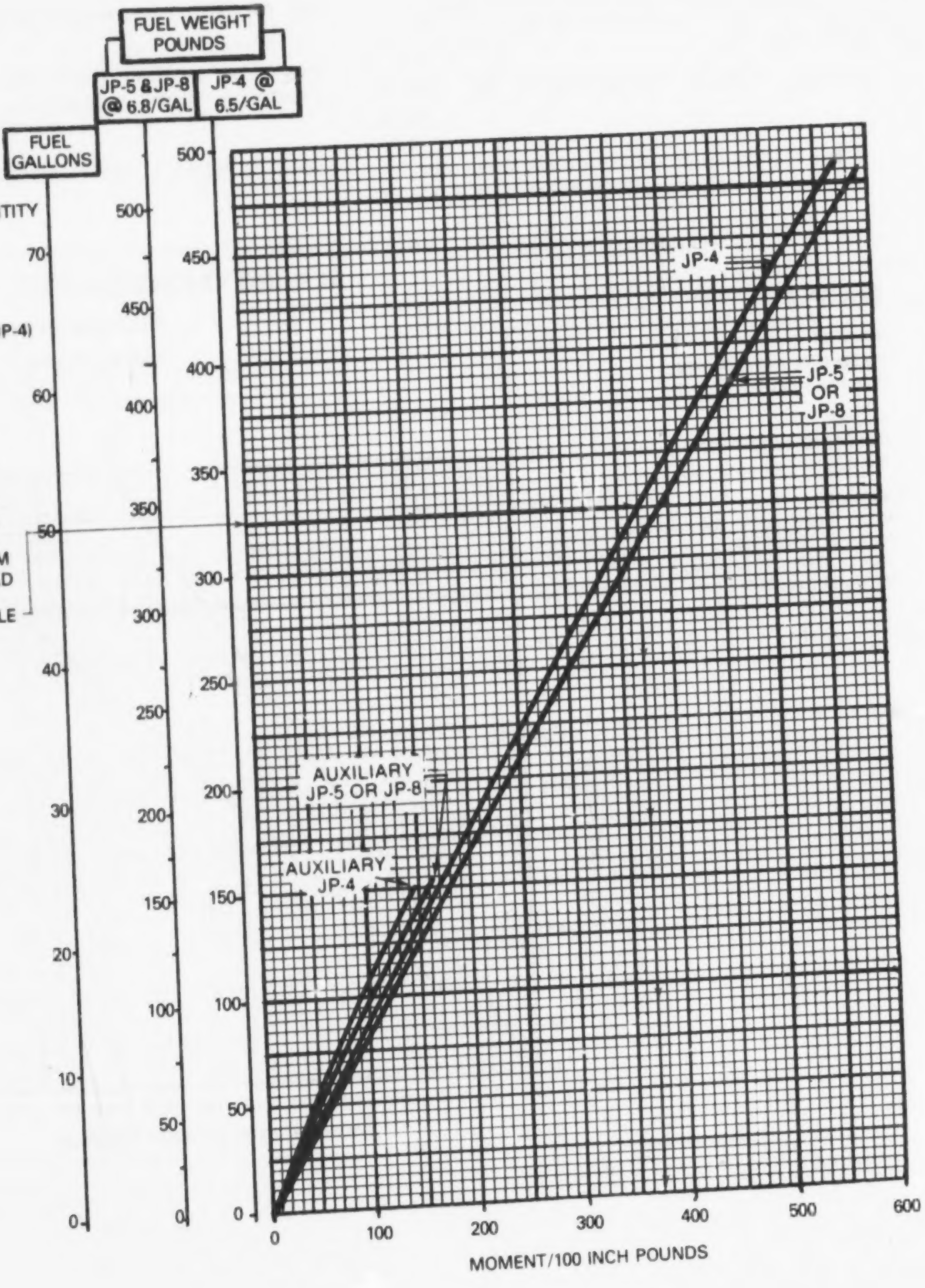


Figure 6-4. Fuel Loading Chart

EXAMPLE:

WANTED
PERSONNEL MOMENT FOR ONE PASSENGER

KNOWN
PERSONNEL WEIGHT OF 200 POUNDS IN BACK SEAT

METHOD
MOVE RIGHT FROM 200 POUNDS TO BACK SEAT LINE.
MOVE DOWN TO READ 208 ON MOMENT/100 SCALE

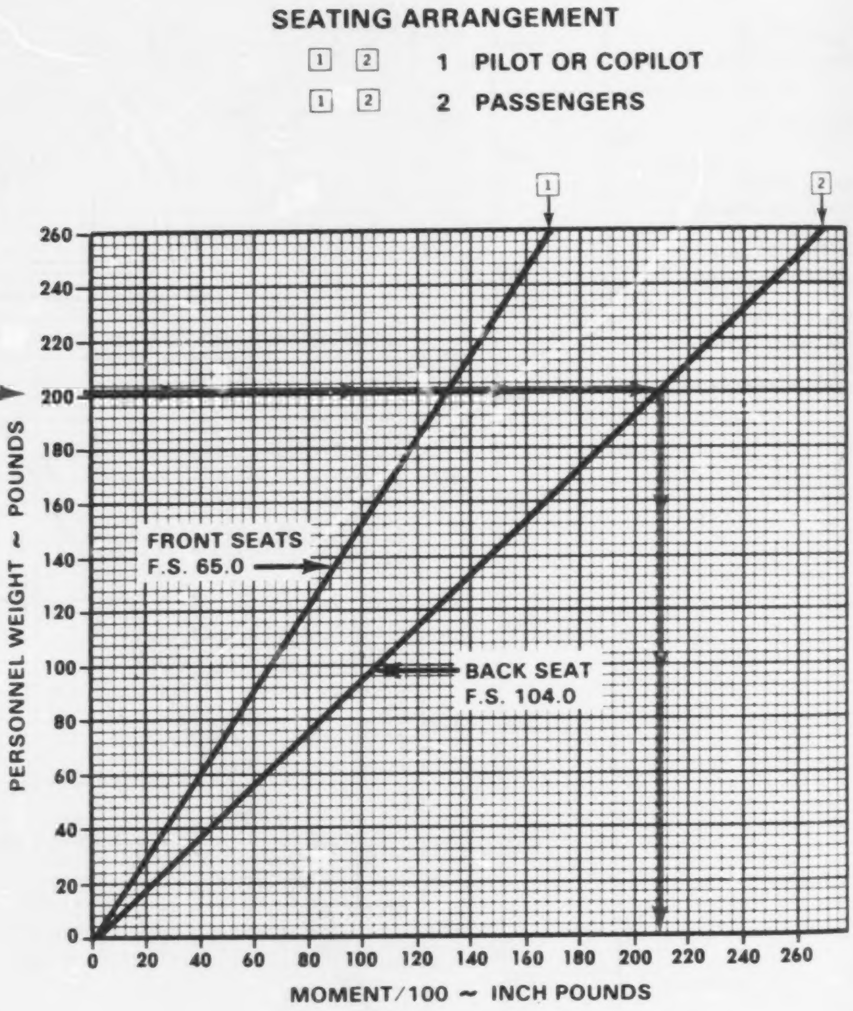


Figure 6-5. Personnel Loading

b. Combat equipped paratroopers: 260 lbs. per individual.

c. Crew and passengers with no equipment compute weight according to each individual's estimate.

6-11. A AMMUNITION TABLE (Figure 6-6).

The ammunition table provides moment/100 data at stations 105.6 and 108.6 in 50 round increments.

NOTE

The ammunition boxes are mounted on gun support tube in passenger area. The boxes contain 7.62 MM (linked) ammunition. The aft box feeds first.

6-12. A ARMAMENT TABLE (Figure 6-7).

The armament table provides moment/100 data at station 108.0 for the M27E1 subsystem.

6-13. CARGO MOMENT.

Refer to Cargo Moment Chart, figure 6-8, for computing cargo weight and balance information.

FORWARD BOX		
ROUNDS (NUMBER)	WEIGHT (LBS) NO. OF ROUNDS IND. PLUS AMMO. BOX	MOMENT/100 F.S. 105.6
0	6.0	6
50	9.3	10
100	12.5	13
150	15.8	17
200	19.0	20
250	22.3	24
300	25.5	27
350	28.8	30
400	32.0	34
450	35.3	37
500	38.5	41
550	41.8	44
600	45.0	48
650	48.3	51
700	51.5	54
750	54.8	58
800	58.0	61
850	61.3	65
900	64.5	68
950	67.8	72
1000	71.0	75

AFT BOX		
ROUNDS (NUMBER)	WEIGHT (LBS) NO. OF ROUNDS IND. PLUS AMMO. BOX	MOMENT/100 F.S. 108.6
0	6.0	7
50	9.3	10
100	12.5	14
150	15.8	17
200	19.0	21
250	22.3	24
300	25.5	28
350	28.8	31
400	32.0	35
450	35.3	38
500	38.5	42
550	41.8	45
600	45.0	49
650	48.3	52
700	51.5	56
750	54.8	60
800	58.0	63
850	61.3	67
900	64.5	70
950	67.8	74
1000	71.0	77

206099-37

Figure 6-6. Ammunition Table A

ARMAMENT SUBSYSTEM M27E1		
NOMENCLATURE	**WEIGHT (LBS)**	**MOMENT/100 F.S. 108.0**
SUBSYSTEM M27E1	106	114.5

206099-38

Figure 6-7. Armament Table A

CARGO LOADING

CARGO PLATFORM
WEIGHS 32 POUNDS
WITH A MOMENT/100
OF 30

EXAMPLE

WANTED

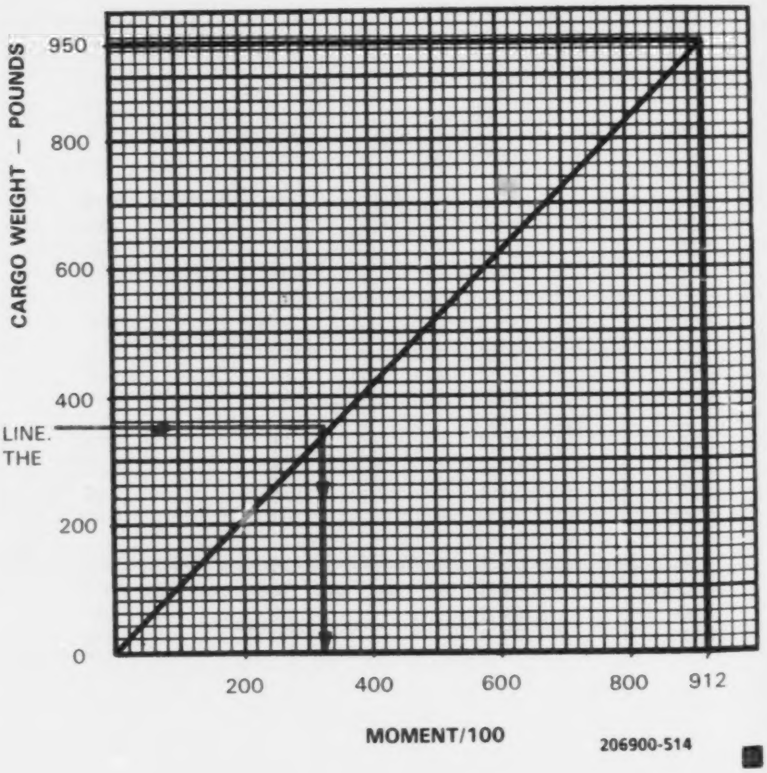
CARGO MOMENT

KNOWN

CARGO WEIGHT = 350 POUNDS

METHOD

MOVE RIGHT FROM 350 TO DIAGONAL LINE. THEN MOVE DOWN AND READ 325 ON THE MOMENT SCALE.



206900-514

Figure 6-8. Cargo Moment Chart

SECTION II. DD FORM 365

6-14. DD FORM 365-1 — BASIC WEIGHT CHECK LIST.

The form is a tabulation of equipment that is, or may be, installed and for which provision for fixed stowage has been made in a definite location. The form gives the weight, arm, and moment/100 of individual items for use in correcting the basic weight and moment on DD Form 365-3 as changes are made in this equipment.

6-15. DD FORM 365-3 — BASIC WEIGHT AND BALANCE RECORD.

The form is a continuous history of the basic weight and moment resulting from structural and equipment changes. At all times the last entry is considered current weight and balance status of the basic helicopter.

6-16. DD FORM 365-4 — WEIGHT AND BALANCE CLEARANCE FORM F.

The form is a summary of actual disposition of the load in the helicopter. It records the balance status of the helicoopter, step-by-step. It serves as a worksheet on which to record weight and balance calculations, and any corrections that must be made to ensure that the helicopter will be within weight and cg limits.

CHAPTER 7

PERFORMANCE DATA

SECTION I. INTRODUCTION

7-1. PURPOSE.

The purpose of this chapter is to provide the best available performance data for the OH-58A/C helicopter. Regular use of this information will enable you to receive maximum safe utilization from the aircraft. Although maximum performance is not always required, regular use of this chapter is recommended for the following reasons.

a. Knowledge of your performance margin will allow you to make better decisions when unexpected conditions or alternate missions are encountered.

b. Situations requiring maximum performance will be readily recognized.

c. Familiarity with the data will allow performance to be computed more easily and quickly.

d. Experience will be gained in accurately estimating the effects of variables for which data are not presented.

NOTE

The information provided in this chapter is primarily intended for mission planning and is most useful when planning operations in unfamiliar areas or at extreme conditions. The data may also be used inflight, to establish unit or area standing operating procedures, and to inform ground commanders of performance/risk tradeoffs.

7-2. CHAPTER 7 INDEX.

The following index contains a list of the sections and their titles, the figure numbers, subjects and page numbers of each performance data chart contained in this chapter.

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7-3. GENERAL.

The data presented covers the maximum range of conditions and performance that can reasonably be expected. In each area of performance, the effects of altitude, temperature, gross weight, and other parameters relating to that phase of flight are presented. In addition to the presented data, your judgment and experience will be necessary to accurately obtain performance under a given set of circumstances. The conditions for the data are listed under the title of each chart. The effects of different conditions are discussed in the text accompanying each phase of performance. Where practical, data are presented at conservative conditions. However, NO GENERAL CONSERVATISM HAS BEEN APPLIED. All performance data presented are within the applicable limits of the aircraft.

7-4. LIMITS.

Applicable limits are shown on the charts as red lines. Performance generally deteriorates rapidly beyond limits. If limits are exceeded, minimize the amount and time. Enter the maximum value and time above limits on DA Form 2408-13 so proper maintenance action can be taken.

7-5. USE OF CHARTS.

a. **Chart Explanation.** The first page of each section describes the chart(s) and explains its uses.

b. **Color Coding.** Chart color codes are used as follows:

(1) Green is used for example guidelines.

(2) Red is used for limit lines.

(3) Yellow is used for precautionary or time-limited operation.

c. **Reading the Charts.** The primary use of each chart is given in an example and green guideline is provided to help you follow the route through the chart. The use of a straight edge (ruler or page edge) and a hard fine point pencil is recommended to avoid cumulative errors. The majority of the charts provide a standard pattern for use as follows: enter first variable on top left scale, move right to the second variable, reflect down at right angles to the third variable, reflect left at right angles to the fourth variable, reflect down, etc. until the final variable is read out at the final scale. In addition to the primary use, other uses of each chart are explained in the text accompanying each set of performance charts. Colored registration blocks located at the bottom and top of each chart are used to determine if slippage has occurred during printing. If slippage has occurred, refer to chapter 5 for correct operating limits.

NOTE

An example of an auxiliary use of the charts referenced above is as follows: Although the hover chart is primarily arranged to find torque required to hover, by entering torque available as torque required, maximum skid height for hover can also be found. In general, any single variable can be found if all others are known. Also, the tradeoffs between two variables can be found. For example, at a given density altitude and pressure altitude, you can find the maximum gross weight capability as free air temperature changes.

The primary advantage of the helicopter over other aircraft is the capability to hover and takeoff and land vertically (zero air speed flight). To more rapidly calculate the performance trade-offs in hover mode, a Hover Ceiling Chart has been included.

7-6. DATA BASIS.

The type of data used is indicated at the bottom of each performance chart under DATA BASIS. The applicable report and date of the data are also given. The data provided generally is based on one of four categories:

a. **Flight Test Data.** Data obtained by flight test of the aircraft by experience flight test personnel at precise conditions using sensitive calibrated instruments.

b. **Derived From Flight Test.** Flight test data obtained on a similar rather than the same aircraft and series. Generally small corrections will have been made.

c. **Calculated Data.** Data based on tests, but not on flight test of the complete aircraft.

d. **Estimated Data.** Data based on estimates using aerodynamic theory or other means but not verified by flight test.

7-7. SPECIFIC CONDITIONS.

The data presented are accurate only for specific conditions listed under the title of each chart. Variables for which data are not presented, but which may affect that phase of performance, are discussed in the text. Where data are available or reasonable estimates can be made, the amount that each variable affects performance will be given.

7-8. GENERAL CONDITIONS.

In addition to the specific conditions, the following general conditions are applicable to the performance data.

a. **Rigging.** All airframe and engine controls are assumed to be rigged within allowable tolerances.

b. **Pilot Technique.** Normal pilot technique is assumed. Control movements should be smooth and continuous.

c. **Aircraft Variation.** Variations in performance between individual aircraft are known to exist; however, they are considered to be small and cannot be individually accounted for.

d. **Instrument Variation.** The data shown in the performance charts do not account for instrument inaccuracies or malfunctions.

7-9. PERFORMANCE DISCREPANCIES.

Regular use of this chapter will allow you to monitor instruments and other aircraft systems for malfunction, by comparing actual performance with planned performance. Knowledge will also be gained concerning the effects of variables for which data are not provided, thereby increasing the accuracy of performance predictions.

7-10. DEFINITIONS OF ABBREVIATIONS.

a. Unless otherwise indicated in the following list of abbreviations, abbreviations and symbols used in this manual conform to those established in Military Standard MIL-STD-12, which is periodically revised to reflect current changes in abbreviations usage. Accordingly, it may be noted that certain previously established definitions have been replaced by more current abbreviations and symbols.

b. Capitalization and punctuation of abbreviations varies, depending upon the context in which they are used. In general, lower case abbreviations are used in text material, whereas abbreviations used in charts and illustrations appear in full capital letters. Periods do not usually follow abbreviations; however, periods are used with abbreviations that could be mistaken for whole words if the period were omitted.

c. The following list provides definitions for abbreviations used in this manual. The same abbreviation applies for either singular or plural applications.

LIST OF ABBREVIATIONS

Abbreviation	Definition
AGL	Above ground level
ALT	Altitude
AVAIL	Available
C	Celsius
CAS	Calibrated airspeed
CL	Centerline
CONFIG	Configuration
CONT	Continuous
ECU	Environmental Control Unit
END	Endurance
F	Fahrenheit
FAT	Free air temperature
FLT	Flight
FT	Foot
FT/MIN	Foot per minute
FWD	Forward
ΔF	Increment of equivalent flat plate drag area
GAL	Gallon
GAL/HR	Gallons per hour
GW	Gross weight
HP	Horsepower

LIST OF ABBREVIATIONS (Cont)

Abbreviation	Definition
HR	Hour
IAS	Indicated airspeed
IGE	In ground effect
IN	Inch
IN HG	Inches of mercury
IR	Infrared
KIAS	Knots indicated airspeed
KN	Knot
°	Degree
OGE	Out of ground effect
LB	Pound
LB/HR	Pounds per hour
LIM	Limit
MAX	Maximum
MIN	Minute
MIN	Minimum
MM	Millimeter
N1	Gas producer speed
N_2	Power turbine speed
NO.	Number
NM	Nautical Mile
%Q	Percent torque
PRESS	Pressure
PSI	Per square inch
R/C	Rate of climb
R/D	Rate of descent
RPM	Revolutions per minute
SPEC	Specifications
STA	Station
SQ FT	Square feet
TAS	True airspeed
TOT	Turbine outlet temperature
TRQ	Torque
USAASTA	United States Army Aviation Systems Test Activity
VDC	Volts, direct current
V_{NE}	Velocity, never exceed (airspeed limitation)
XMSN	Transmission

SECTION II. TEMPERATURE CONVERSION

7-11. FREE AIR TEMPERATURES.

A temperature conversion chart (figure 7-1) is included for the purpose of converting Fahrenheit temperature to Celsius.

TEMPERATURE CONVERSION

EXAMPLE

WANTED

FREE AIR TEMPERATURE IN DEGREES CELSIUS

KNOWN

FREE AIR TEMPERATURE = +32°F

METHOD

ENTER FREE AIR TEMPERATURE
HERE
MOVE RIGHT TO DIAGONAL LINE
MOVE DOWN TO DEGREES CELSIUS SCALE
READ FREE AIR TEMPERATURE = 0°C

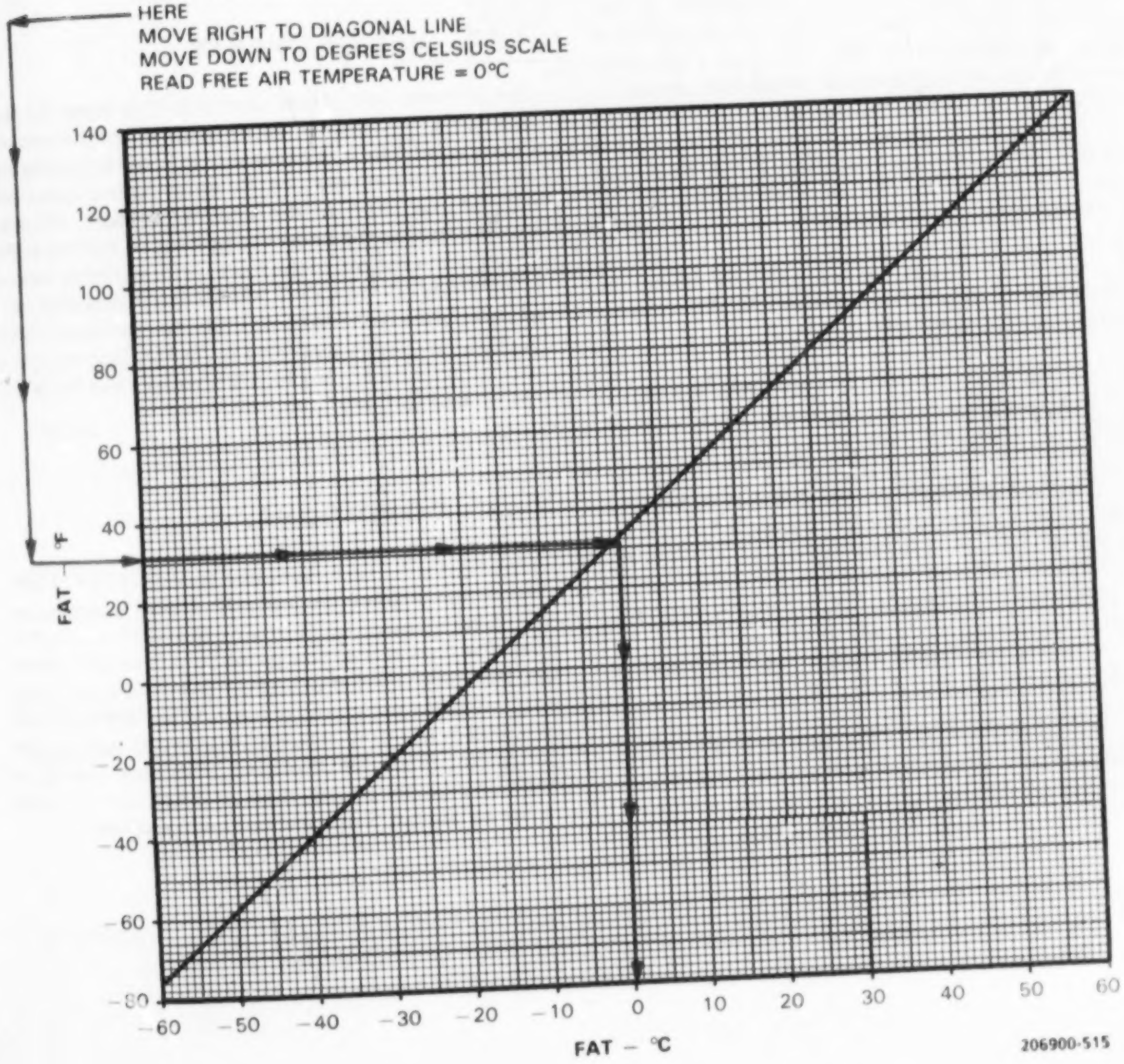


Figure 7-1. Temperature Conversion Chart

SECTION III. TORQUE AVAILABLE A

7-12. DESCRIPTION.

The torque available charts show the effects of altitude and temperature on engine torque.

7-13. CHART DIFFERENCES.

Both pressure altitude and FAT affect engine power production. Figures 7-2 and 7-3 show power available data at 30 minute power and maximum continuous power ratings in terms of the allowable torque as recorded by the torque meter (PSI).

Note that the power output capability of the T63-A-700 engine can exceed the transmission structural limit (92 PSI) under certain conditions.

a. Figure 7-2 (sheet 1) is applicable for maximum power, engine deice, and heater off, 30 minute operation at 103% N2 rpm.

b. Figure 7-2 (sheet 2) is applicable for maximum power, engine deice, and heater on, 30 minute operation at 103% N2 rpm.

c. Figure 7-2 (sheet 3) is applicable for maximum power, engine deice, and heater off and reverse flow inlet installed, 30 minute operation at 103% N2 rpm.

d. Figure 7-2 (sheet 4) is applicable for maximum power, engine deice, and heater on and reserve flow inlet installed, 30 minute operation at 103% N2 rpm.

e. Figure 7-3 (sheets 1 through 4) is applicable for maximum continuous power for the above mentioned conditions.

f. Prolonged IGE hover may increase engine inlet temperature as much as 10°C.

g. The thirty minute operation is limited by TOT being in the yellow range on TOT gage.

7-14. USE OF CHARTS.

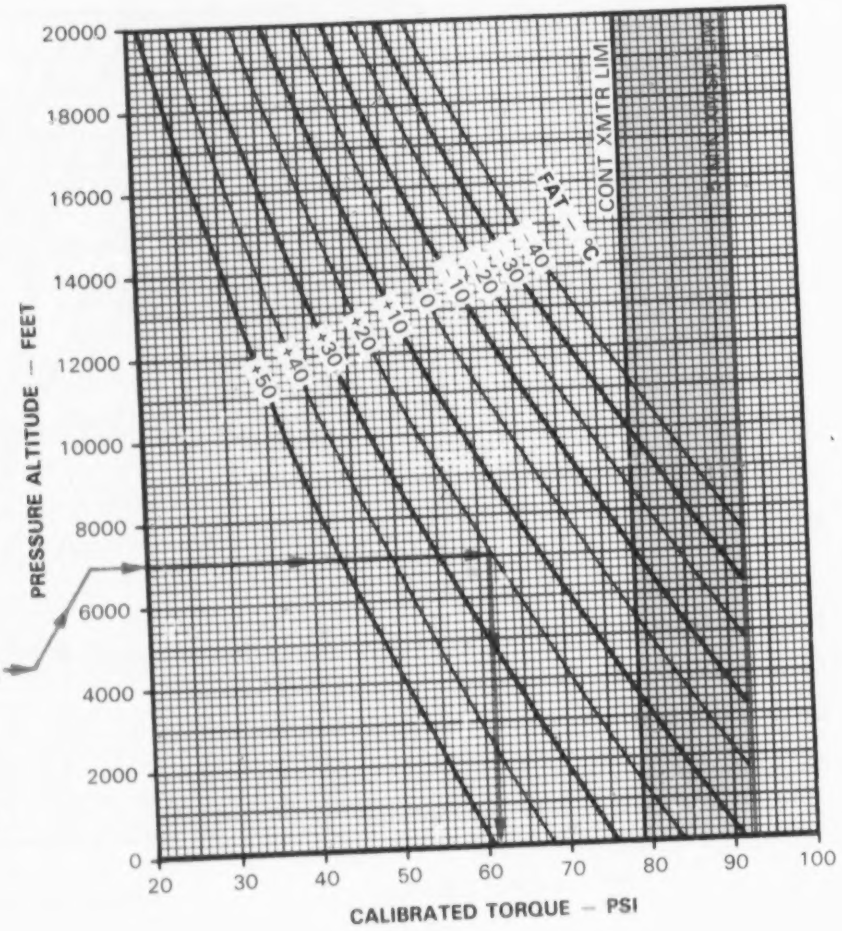
The primary use of the charts is illustrated by the examples. In general, to determine the maximum power available, it is necessary to know the pressure altitude and temperature. By entering the upper left side of the chart at the known pressure altitude, moving right to the known temperature, then straight down to the bottom of the lower grid, available torque is obtained. If the CONT XMSN LIMIT line is intersected prior to reaching the temperature line, continuous torque available is 79 PSI. Operations in the yellow area of the chart (between 79 and 92 PSI) are limited to 5 minutes.

7-15. CONDITIONS.

Chart (figure 7-2) is based upon speeds @ 354/103% rotor/engine rpm with grade JP-4 fuel. Chart (figure 7-3) is based upon 103% engine rpm with grade JP-4 fuel. The use of aviation gasoline will not influence engine power. Fuel grade of JP-5 will yield the same nautical miles per pound of fuel and being 6.8 pounds per gallon will only result in increased fuel weight per gallon. Because JP-4 and JP-5 have the same energy value per pound, then JP-5 fuel will increase range by almost 5 percent per gallon of fuel.

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)
ENGINE DEICE AND HEATER OFF
103% RPM

MAXIMUM
TORQUE
OH-58A
T63-A-700



EXAMPLE

WANTED

CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE =7000 FEET

FAT = +20°C

METHOD

ENTER PRESSURE ALTITUDE HERE

MOVE RIGHT TO FAT

MOVE DOWN, READ

CALIBRATED TORQUE =61.4 PSI

DATA BASIS: CALCULATED FROM MODEL SPEC 803, 19 JULY 1968, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USA ASTA 68-30, SEPTEMBER, 1970

206900-516-1

Figure 7-2. Maximum Torque Available (30 Minute Operation) Chart **A** (Sheet 1 of 4)

MAXIMUM TORQUE AVALIABLE (30 MINUTE OPERATION)

ENGINE DEICE AND HEATER ON
103% RPM

MAXIMUM
TORQUE
OH-58A
T63-A-700

EXAMPLE

WANTED

CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE =7000 FEET

FAT = +20°C

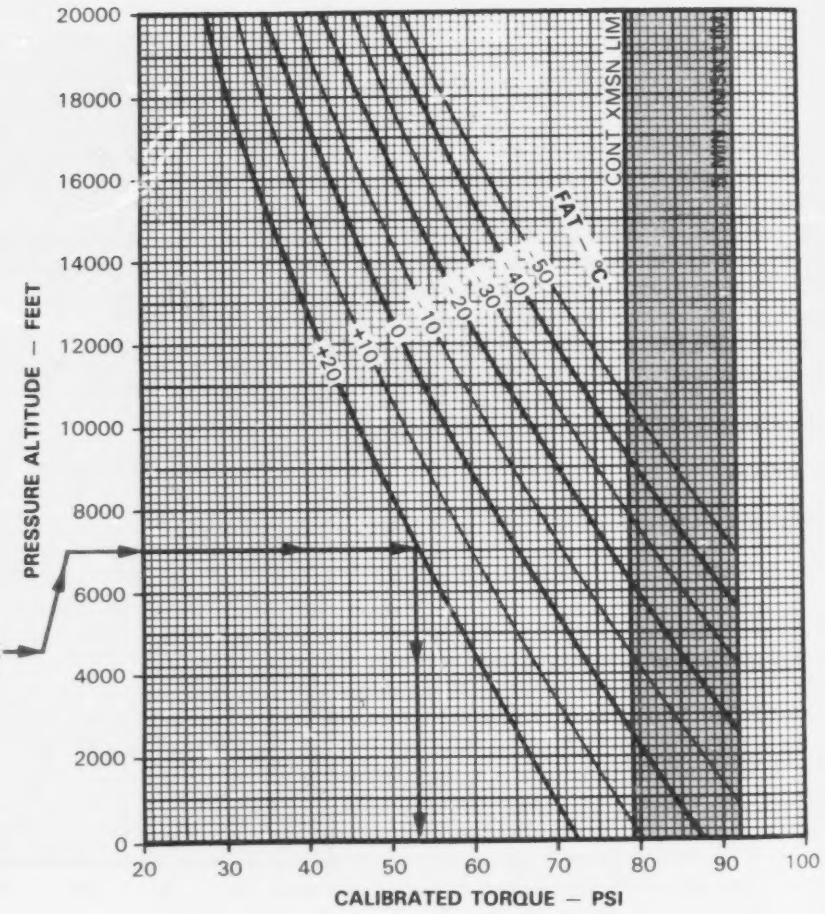
METHOD

ENTER PRESSURE ALTITUDE HERE

MOVE RIGHT TO FAT

MOVE DOWN, READ

CALIBRATED TORQUE =53.0 PSI



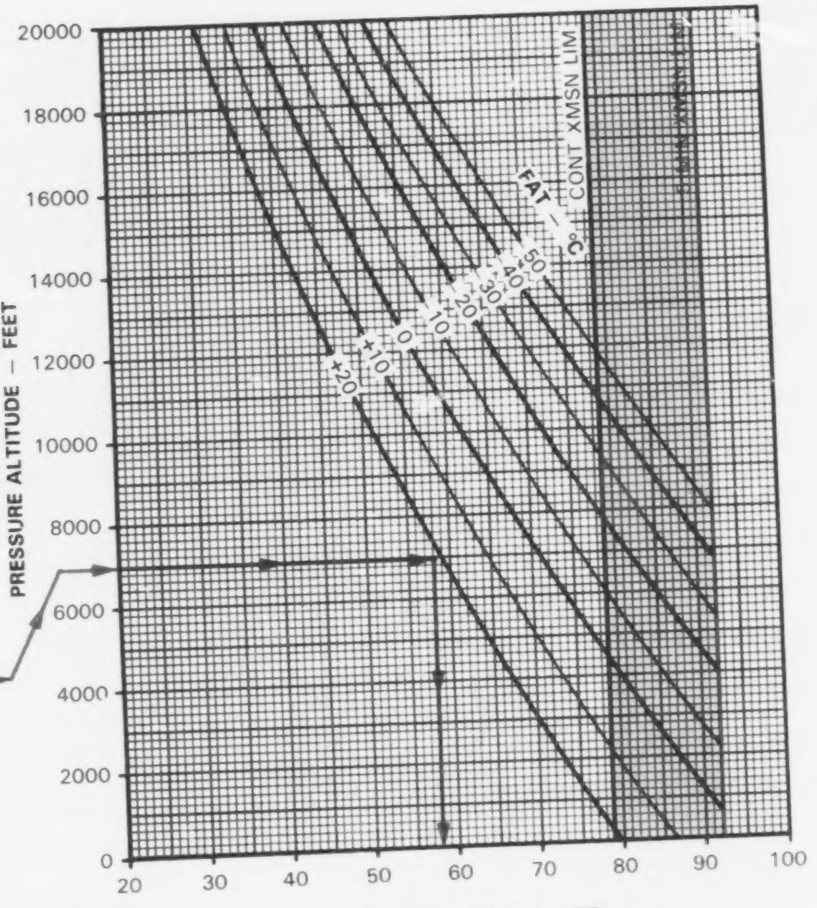
DATA BASIS: CALCULATED FROM MODEL SPEC 803, 19 JULY 1968, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USA ASTA 68-30, SEPTEMBER 1970.

206900-516-2

Figure 7-2. Maximum Torque Available (30 Minute Operation) Chart A (Sheet 2 of 4)

MAXIMUM
TORQUE
OH-58A
T63-A-700

MAXIMUM TORQUE AVALIABLE (30 MINUTE OPERATION)
ENGINE DEICE AND HEATER OFF AND REVERSE FLOW INLET INSTALLED
103% RPM



EXAMPLE

WANTED

CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET

FAT = +20°C

METHOD

ENTER PRESSURE ALTITUDE HERE

MOVE RIGHT TO FAT

MOVE DOWN, READ

CALIBRATED TORQUE =58.8 PSI

DATA BASIS: CALCULATED FROM MODEL SPEC 803, 19 JULY 1968, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USA ASTA 68-30, SEPTEMBER 1970.

206900-516-3

Figure 7-2. Maximum Torque Available (30 Minute Operation) Chart **A** (Sheet 3 of 4)

MAXIMUM
TORQUE
OH-58A
T63-A-700

MAXIMUM TORQUE AVALIABLE (30 MINUTE OPERATION)

ENGINE DEICE AND HEATER ON AND REVERSE FLOW INLET INSTALLED

103% RPM

EXAMPLE

WANTED

CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE — 7000 FEET

FAT — +20°C

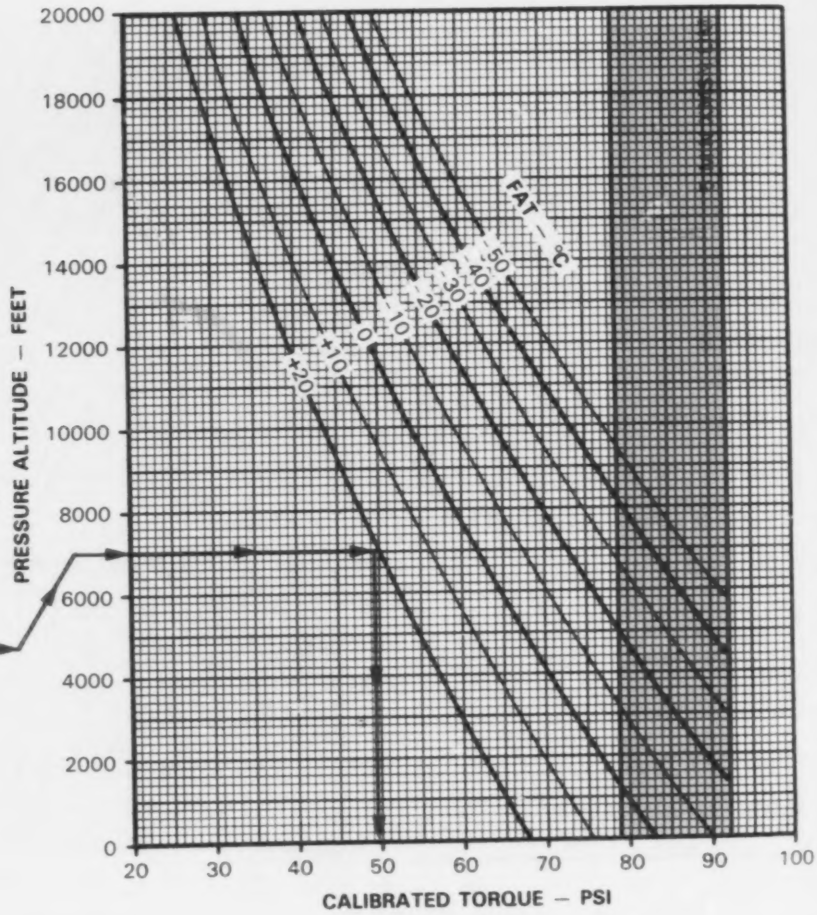
METHOD

ENTER PRESSURE ALTITUDE HERE

MOVE RIGHT TO FAT

MOVE DOWN, READ

CALIBRATED TORQUE =49.8 PSI



DATA BASIS: CALCULATED FROM MODEL SPEC 803, 19 JULY 1968, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USA ASTA 68-30, SEPTEMBER 1970.

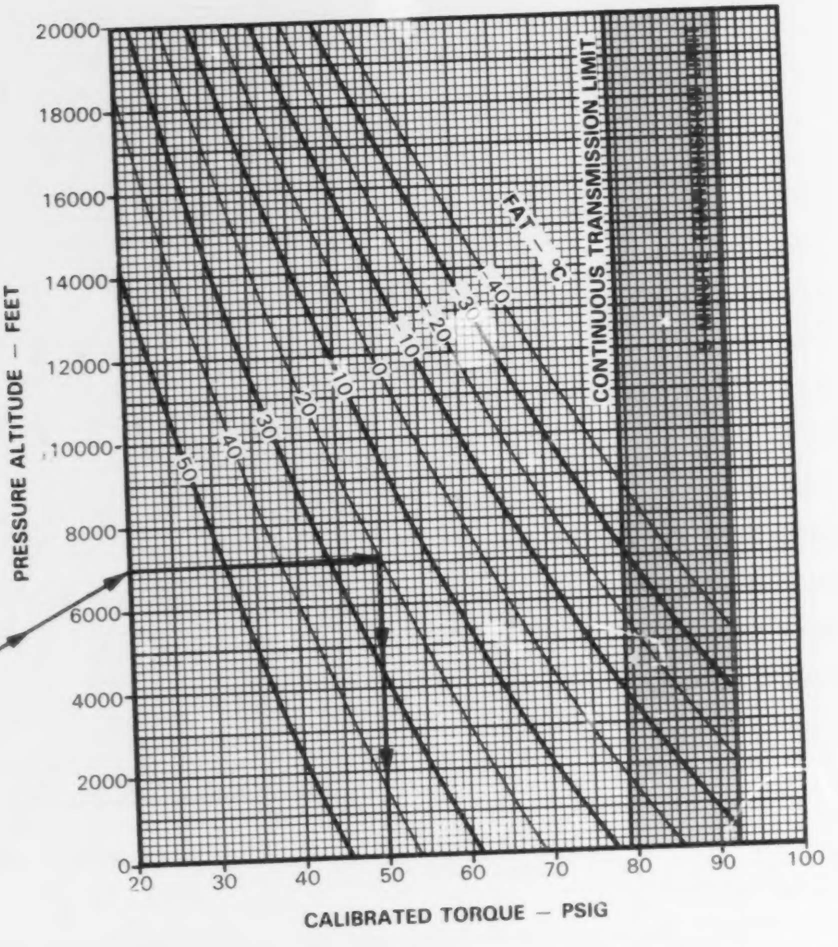
206900-516-4

Figure 7-2. Maximum Torque Available (30 Minute Operation) Chart **A** (Sheet 4 of 4)

TORQUE AVAILABLE (CONTINUOUS OPERATION)

ENGINE DEICE AND HEATER OFF
103% RPM

TORQUE AVALIABLE
OH-58A
T63-A-700



EXAMPLE

WANTED

CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET

FAT = +20°C

METHOD

ENTER PRESSURE ALTITUDE HERE

MOVE RIGHT TO FAT

MOVE DOWN, READ

CALIBRATED TORQUE = 50.1 PSI

DATA BASIS: CALCULATED FROM MODEL SPEC 803, 19 JULY 1968, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USA ASTA 68-30, SEPTEMBER 1970.

206900-517-1

Figure 7-3. Torque Available (Continuous Operation) Chart A (Sheet 1 of 4)

TORQUE AVAILABLE (CONTINUOUS OPERATION)
ENGINE DEICE AND HEATER ON
103% RPM

TORQUE
AVALIABLE
OH-58A
T63-A-700

EXAMPLE

WANTED

CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET

FAT = +20°C

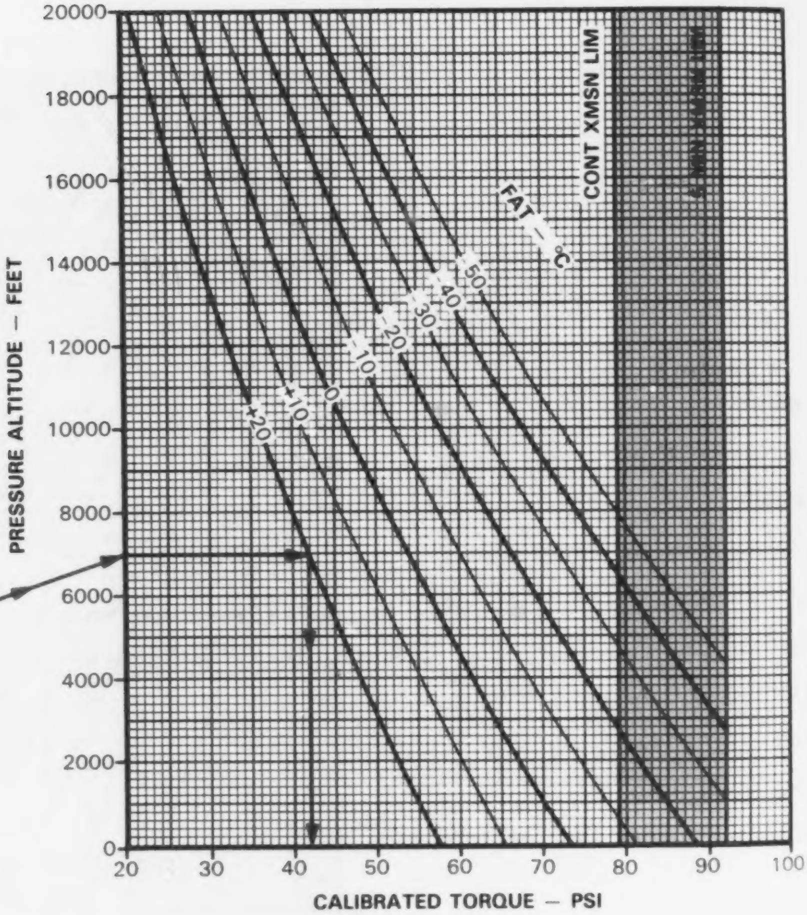
METHOD

ENTER PRESSURE ALTITUDE HERE

MOVE RIGHT TO FAT

MOVE DOWN, READ

CALIBRATED TORQUE = 42.0 PSI



DATA BASIS: CALCULATED FROM MODEL SPEC 803, 19 JULY 1968, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USA ASTA 68-30, SEPTEMBER 1970.

206900-517-2

Figure 7-3. Torque Available (Continuous Operation) Chart A (Sheet 2 of 4)

TORQUE AVALIABLE (CONTINUOUS OPERATION) ENGINE DEICE AND HEATER OFF AND REVERSE FLOW INLET INSTALLED
103% RPM

TORQUE
AVALIABLE
OH-58A
T63-A-700

EXAMPLE

WANTED

CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET

FAT = +20°C

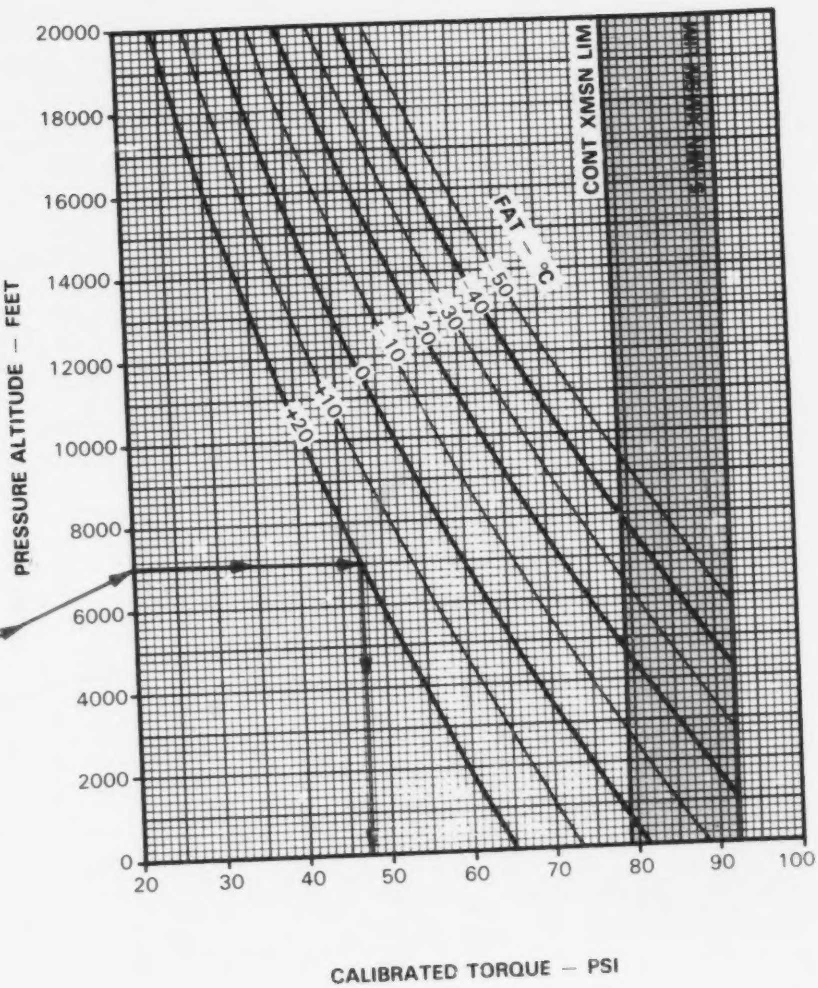
METHOD

ENTER PRESSURE ALTITUDE HERE

MOVE RIGHT TO FAT

MOVE DOWN, READ

CALIBRATED TORQUE = 47.5 PSI



DATA BASIS: CALCULATED FROM MODEL SPEC 803, 19 JULY 1968, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USA ASTA 68-30, SEPTEMBER 1970.

206900-517-3

Figure 7-3. Torque Available (Continuous Operation) Chart **A** (Sheet 3 of 4)

TORQUE AVALIABLE (CONTINUOUS OPERATION)
ENGINE DEICE AND HEATER ON, AND REVERSE FLOW INLET INSTALLED
103% RPM

TORQUE
AVALIABLE
OH-58A
T63-A-700

EXAMPLE

WANTED

CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET

FAT = +20°C

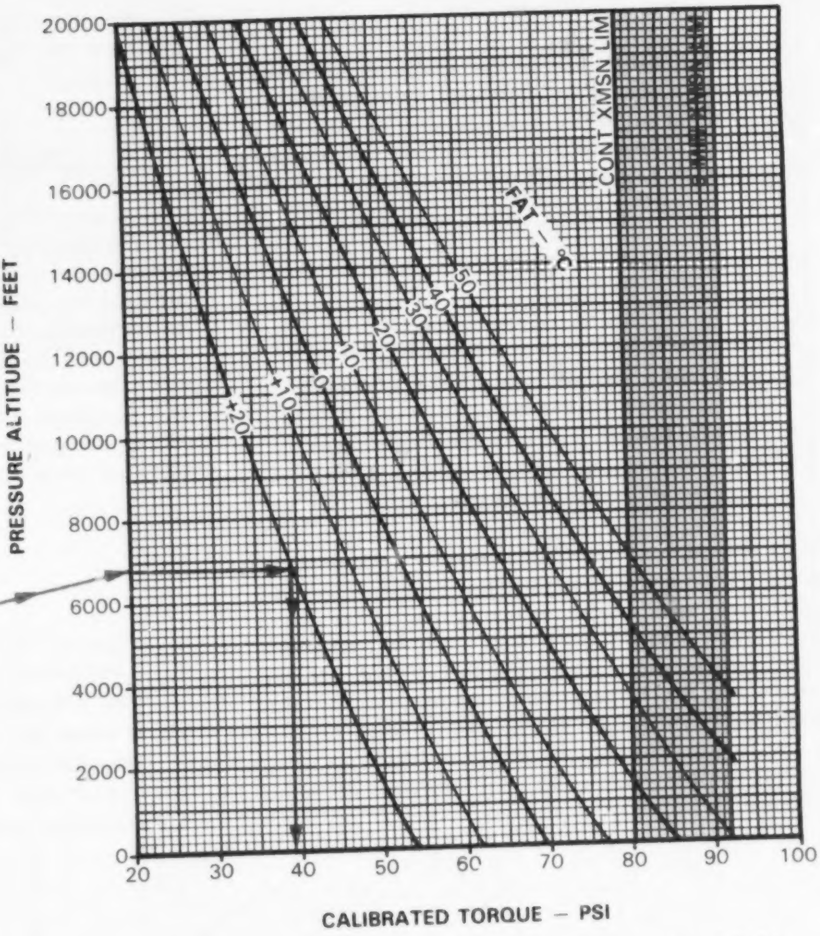
METHOD

ENTER PRESSURE ALTITUDE HERE

MOVE RIGHT TO FAT

MOVE DOWN, READ

CALIBRATED TORQUE = 39.3 PSI



DATA BASIS: CALCULATED FROM MODEL SPEC 803, 19 JULY 1968, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USA ASTA 68-30, SEPTEMBER 1970.

206900-517-4

Figure 7-3. Torque Available (Continuous Operation) Chart **A** (Sheet 4 of 4)

SECTION IV. HOVER A

7-16. DESCRIPTION.

The hover charts (figure 7-4, sheets 1 and 2) show the hover ceiling and the torque required to hover respectively at various pressure altitudes, ambient temperatures, gross weights, and skid heights. Maximum skid height for hover can also be obtained by using the torque available from figure 7-2.

7-17. USE OF CHARTS.

a. The primary use of the charts is illustrated by the charts example. In general, to determine the hover ceiling or the torque required to hover it is necessary to know the pressure altitude, temperature, gross weight, and the desired skid height.

CAUTION

Low airspeed maneuvering flights at airspeeds below 35 knots are not recommended under conditions where the power required to hover out of ground effect exceeds the maximum continuous power.

b. In addition to its primary use, the hover chart (sheet 2) can also be used to determine the predicted maximum hover height, which is needed for use of the takeoff chart (figure 7-5); and the maximum right crosswind corresponding to a 10% directional control margin. To determine maximum right crosswind and hover height proceed as follows:

(1) Enter chart at appropriate pressure altitude.

(2) Move right to FAT.

(3) Move down to gross weight, read the maximum right corsswind corresponding to a 10% directional control margin.

(4) Move left to intersection with maximum power available (obtained from figure 7-2).

(5) Read predicted maximum skid height. This height is the maximum hover height.

7-18. CONDITIONS.

The hover charts are based upon calm wind conditions, a level ground surface, and the use of 103% N2 rpm. Controllability during downwind hovering, crosswinds, sideward flight, and rearward flight may be inadequate; however, for stabilized hover in steady winds from the right (i.e., right crosswind) the wind velocities on the chart correspond to the maximum one can have and yet maintain a 10% directional control margin. See Chapter 5 for hovering and low altitude/low airspeed flight limitations.

WARNING

Figure 7-4 (sheet 3 of 3) shows 10% directional control margins only for the stabilized conditions set forth. It does not and is not meant to infer that for corresponding dynamic flight maneuvering conditions such margins exist.

HOVER
OH-58A
T63-A-700

HOVER CEILING
(MAXIMUM TORQUE AVAILABLE — 30 MINUTE OPERATION)
103% RPM

EXAMPLE

WANTED

GROSS WEIGHT TO HOVER

KNOWN

PRESSURE ALTITUDE = 10000 FEET

FAT = 0 °C

SKID HEIGHT = 10 FEET

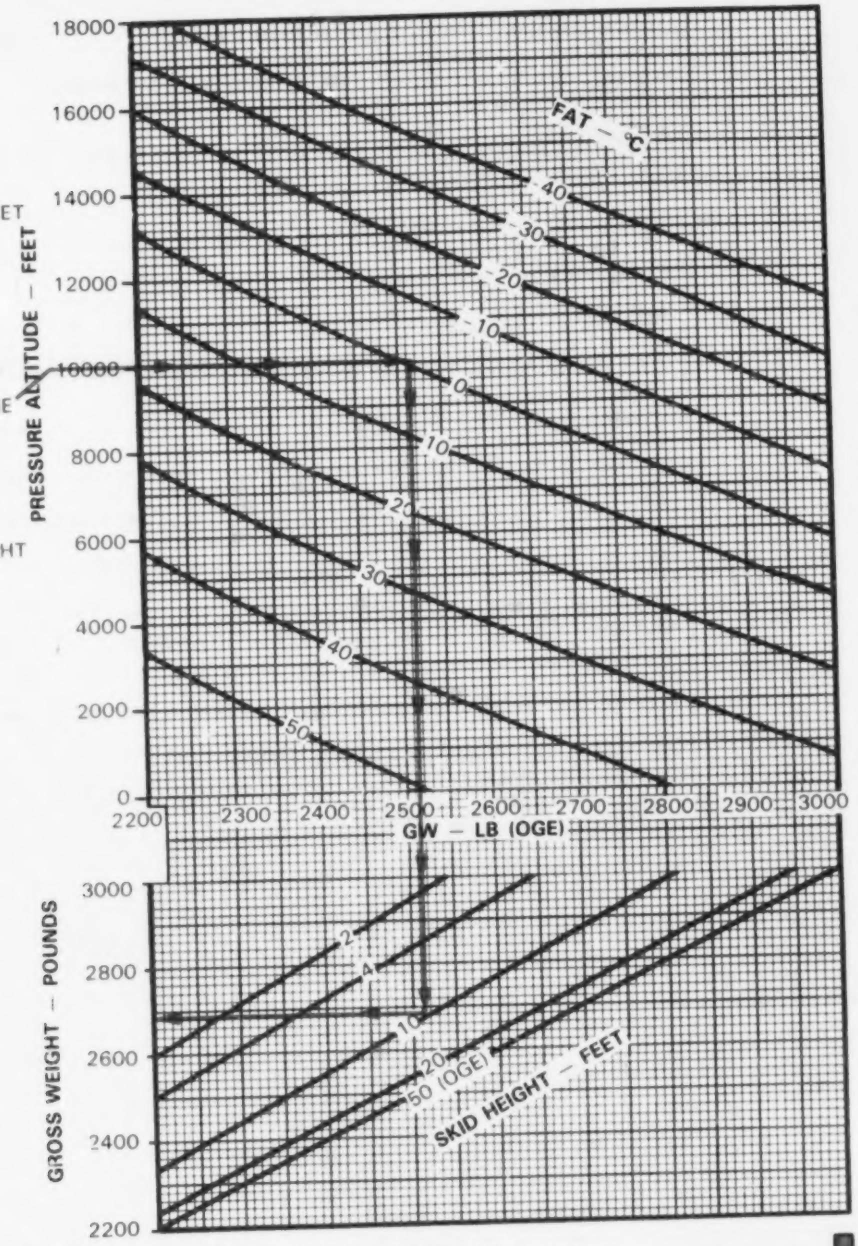
METHOD

ENTER PRESSURE ALTITUDE HERE

MOVE RIGHT TO FAT

MOVE DOWN TO SKID HEIGHT

MOVE LEFT, READ GROSS WEIGHT TO HOVER = 2680 POUNDS



DATA BASIS: DERIVED FROM FLIGHT TEST, USA ASTA 68-30, SEPTEMBER 1970

206900-518-1

Figure 7-4. Hover Chart A (Sheet 1 of 3)

EXAMPLE

WANTED

MAXIMUM GROSS WEIGHT TO HOVER AT OGE (50 FEET) WITH AND WITHOUT REVERSED FLOW INLET INSTALLED.

KNOWN (REFERENCE FIGURE 7-2, SHEETS 1 & 3)

30 MINUTE TORQUE AVALIABLE WITH REVERSE FLOW INLET INSTALLED = 58.8 PSI

30 MINUTE TORQUE AVALIABLE WITHOUT REVERSE FLOW INLET INSTALLED = 61.4 PSI

PRESSURE ALTITUDE = 7000 FEET

FAT = +20°C

METHOD

ENTER PRESSURE ALTITUDE HERE → ①

MOVE RIGHT TO INTERSECT +20°C FAT LINE

DRAW VERTICAL LINE TO BASE OF CHART

ENTER TORQUE HERE FOR NO REVERSE FLOW INLET → ②

MOVE UP TO INTERSECT OGE (50 FEET) SKID HEIGHT LINE

MOVE RIGHT TO INTERSECT THE VERTICAL LINE FROM ① AND READ GROSS WEIGHT TO HOVER = 2470 POUNDS

ENTER TORQUE HERE FOR ENGINE WITH REVERSE FLOW INLET → ③

PROCEED AS ABOVE AND READ GROSS WEIGHT TO HOVER = 2390 POUNDS

206900-518-2

Figure 7-4. Hover Chart A (Sheet 2 of 3)

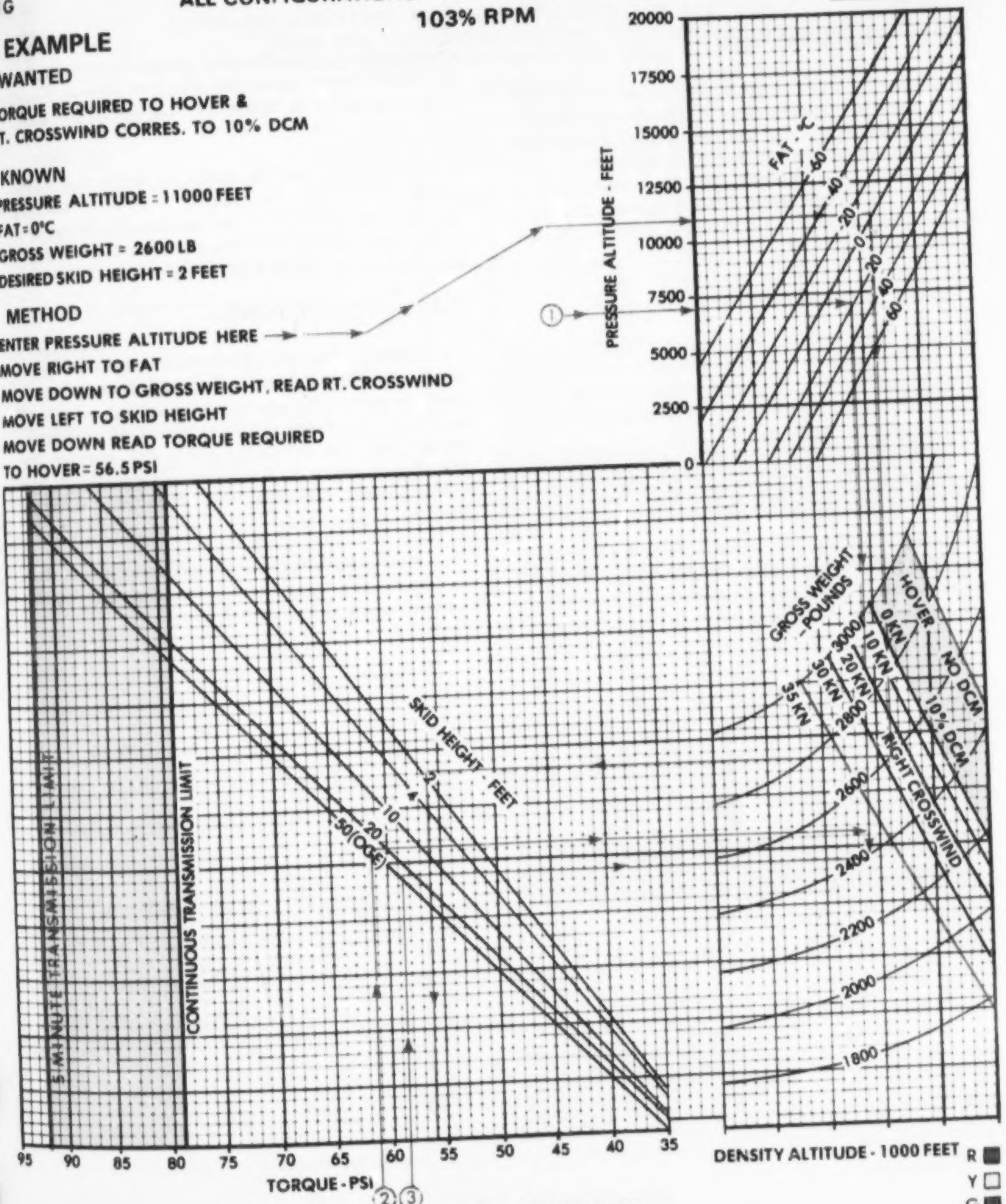
▨ R
☐ Y
▨ G

HOVER

ALL CONFIGURATIONS LEVEL SURFACE CALM WIND

103% RPM

HOVER
OH-58A
T63-A-700



EXAMPLE

WANTED

TORQUE REQUIRED TO HOVER &
RT. CROSSWIND CORRES. TO 10% DCM

KNOWN

PRESSURE ALTITUDE = 11000 FEET
FAT = 0°C
GROSS WEIGHT = 2600 LB
DESIRED SKID HEIGHT = 2 FEET

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO GROSS WEIGHT, READ RT. CROSSWIND
MOVE LEFT TO SKID HEIGHT
MOVE DOWN READ TORQUE REQUIRED
TO HOVER = 56.5 PSI

▨ R
☐ Y
▨ G

DATA BASIS: DERIVED FROM FLIGHT TEST, USA ASTA 68-30, SEPTEMBER 1970

Figure 7-4. Hover Chart **A** (Sheet 3 of 3)

SECTION V. TAKEOFF A

7-19. DESCRIPTION.

The takeoff chart (figure 7-5) shows the distances to clear various obstacle heights, based upon a level acceleration technique. Takeoff distance is shown as a function of several hover height capabilities. The upper chart grid presents data for climbout at a constant 35 knots INDICATED airspeed. The two lower grids present data for climbouts at various TRUE airspeeds.

NOTE

> The hover heights shown on the chart are only a measure of the helicopters climb cabability and do not imply that a higher than normal hover height should be used during the actual takeoff.

7-20. USE OF CHART.

The primary use of this chart is illustrated by the chart example. The main consideration for takeoff performance is the hovering skid height capability, which includes the effects of pressure altitude, free air temperature, gross weight, and torque. Hover height capability is determined by use of the hover chart, figure 7-4.

A hover check can be made to verify the hover capability. If winds are present, the hover check may disclose that the helicopter can actually hover at a greater skid height than the calculated value, since the hover chart is based upon calm wind conditions.

7-21. CONDITIONS.

a. **Wind.** The takeoff chart is based upon calm wind conditions. Since surface wind velocity and direction cannot be accurately predicted, all takeoff planning should be based upon calm wind conditions. Takeoff into any prevailing wind will improve the takeoff performance. A tailwind during takeoff and climbout will increase the obstacle clearance distance.

b. **Power Settings.** All takeoff performance data are based upon the torque used in determining the hover capabilities in figure 7-4.

TAKEOFF
OH-58A
T63-A-700

TAKEOFF

LEVEL ACCELERATION TECHNIQUE FROM A 3 FT SKID HEIGHT
103% RPM; MAXIMUM TORQUE AVAILABLE
ALL CONFIGURATIONS CALM WIND

EXAMPLE A

WANTED

DISTANCE TO CLEAR OBSTACLE

KNOWN

MAXIMUM HOVER HEIGHT = 10 FEET

OBSTACLE HEIGHT = 50 FEET

METHOD

ENTER MAX HOVER HEIGHT HERE

MOVE RIGHT TO OBSTACLE HEIGHT

MOVE DOWN, READ DISTANCE TO CLEAR OBSTACLE = 530 FEET

EXAMPLE B

WANTED

DISTANCE TO CLEAR OBSTACLE

KNOWN

MAX HOVER HEIGHT = 8 FEET

OBSTACLE HEIGHT = 50 FEET

CLIMBOUT AIRSPEED = 40 KNOTS

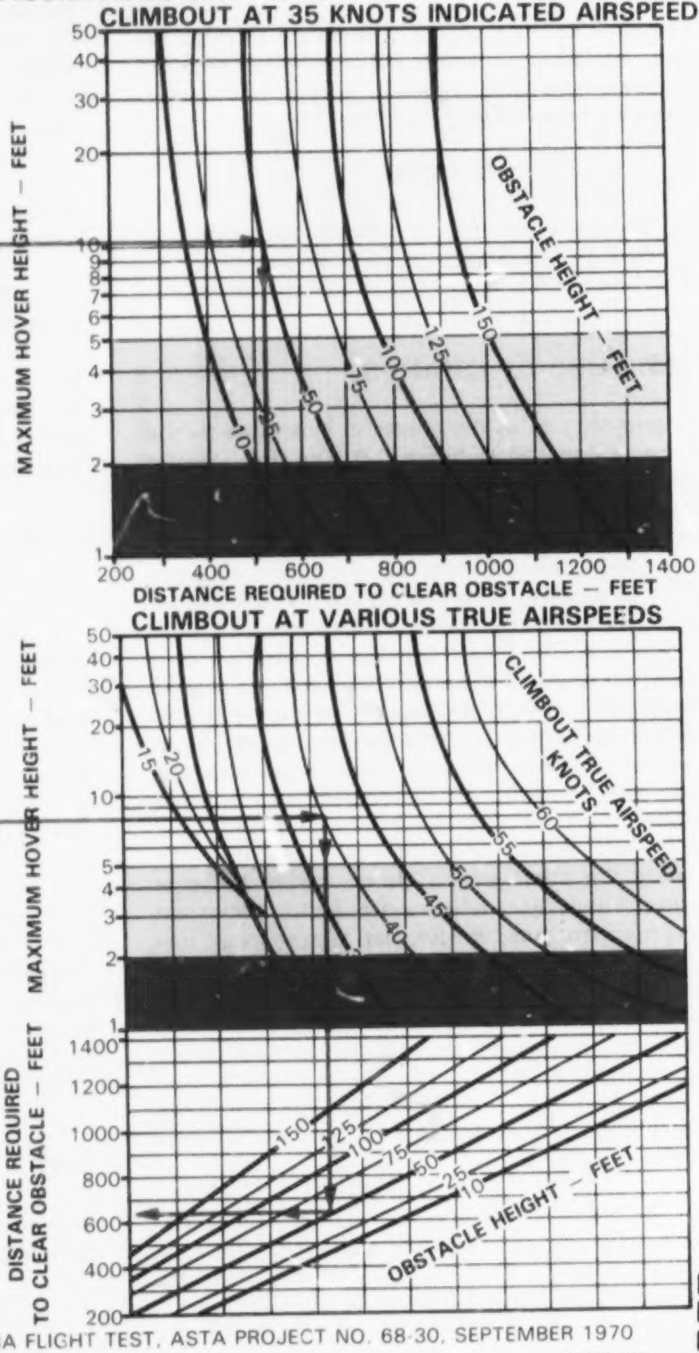
METHOD

ENTER MAX HOVER HEIGHT HERE

MOVE RIGHT TO CLIMBOUT TRUE AIRSPEED

MOVE DOWN TO OBSTACLE HEIGHT

MOVE LEFT, READ DISTANCE TO CLEAR OBSTACLE = 635 FEET



DATA BASIS: DERIVED FROM OH-58A FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-520

Figure 7-5. Takeoff Chart A

SECTION VI. CRUISE **A**

7-22. DESCRIPTION.

The cruise charts (figure 7-6, sheets 1 through 13) show the torque pressure and engine rpm required for level flight at various pressure altitudes, airspeeds, gross weights, and fuel flows.

NOTE

> The cruise charts are basically arranged by FAT groupings. Figure 7-6, sheets 1 through 13, are based upon operation with clean configuration.

7-23. USE OF CHARTS.

The primary use of the charts is illustrated by the examples provided in figure 7-6. The first step for chart use is to select the proper chart, based upon the planned drag configuration, pressure altitude, and anticipated free air temperature; refer to chapter 7 index (paragraph 7-2). Normally, sufficient accuracy can be obtained by selecting the chart nearest to the planned cruising altitude and FAT, or the next higher altitude and FAT (chart Example A, Method 2). If greater accuracy is required, interpolation between altitudes and/or temperatures will be required (chart Example A, Method 1). You may enter the charts on any side: TAS, IAS, torque pressure, or fuel flow, and then move vertically or horizontally to the gross weight, then to the other three parameters. Maximum performance conditions are determined by entering the chart where the maximum range or maximum endurance and rate of climb lines intersect the appropriate gross weight; then read airspeed, fuel flow, and torque pressure. For conservatism, use the gross weight at the beginning of cruise flight. For greater accuracy on long flights it is preferable to determine cruise information for several flight segments in order to allow for decreasing fuel weights (reduced gross weight). The following parameters contained in each chart are further explained as follows:

a. **Airspeed**. True and indicated airspeeds are presented at opposite sides of each chart. On any chart, indicated airspeed can be directly converted to true airspeed (or vice versa) by reading directly across the chart without regard for other chart information. Maximum permissible airspeed (V_{NE}) limits appear as red lines on some charts. If no red line appears, V_{NE} is above the limits of the chart.

b. **Torque (PSI)**. Since pressure altitude and temperature are fixed for each chart, torque varies according to gross weight and airspeed.

c. **Fuel Flow**. Fuel flow scales are provided opposite the torque scales. On any chart, torque may be converted directly to fuel flow without regard for other chart information. All fuel flow information is presented with particle separator and engine deice and heater off. Fuel flow increases 5% with reverse flow inlets installed, 4% with anti-ice on, and 4% with bleed air heater on. With 30,000 BTU combustion heater on add an additional 22.4 lbs per hour. With the 50,000 BTU combustion heater on add an additional 28.8 lbs per hour.

d. **Maximum Range**. The maximum range lines indicate the combinations of weight and airspeed that will produce the greatest flight range per gallon of fuel under zero wind conditions. When a maximum range condition does not appear on a chart it is because the maximum range speed is beyond the maximum permissible speed (V_{NE}); in such cases, use V_{NE} cruising speed to obtain maximum range.

e. **Maximum Endurance and Maximum Rate of Climb**. The maximum endurance and maximum rate of climb lines indicate the airspeed for minimum torque required to maintain level flight for each gross weight, FAT and pressure altitude. Since minimum torque will provide minimum fuel flow, maximum flight endurance will be obtained at the airspeeds indicated.

7-24. CONDITIONS.

The cruise charts are based upon operation at 103% rpm, engine deice and heater off.

CRUISE
OH-58A
T63-A-700

CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
103% RPM

FAT = -30°C

EXAMPLE A

WANTED

TORQUE REQUIRED FOR LEVEL FLIGHT, FUEL FLOW, INDICATED AIRSPEED

KNOWN

CLEAN CONFIGURATION
GROSS WEIGHT = 2600 LB
PRESSURE ALTITUDE = 1000 FEET
FAT = -30 C
DESIRED TRUE AIRSPEED = 90 KNOTS

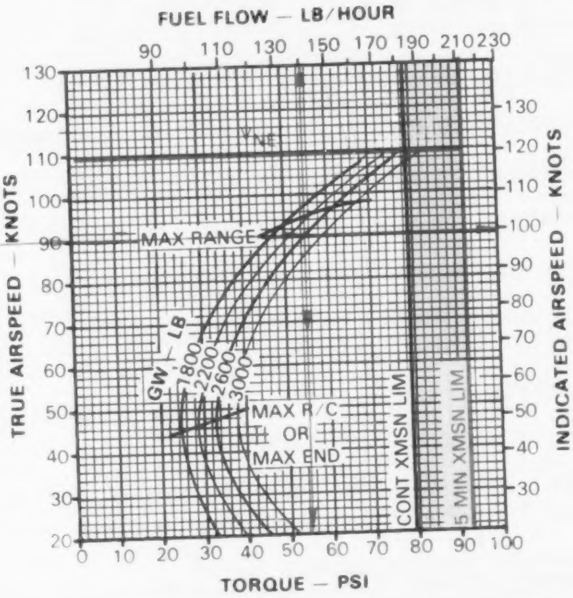
METHOD 1 (INTERPOLATE — MOST ACCURATE)

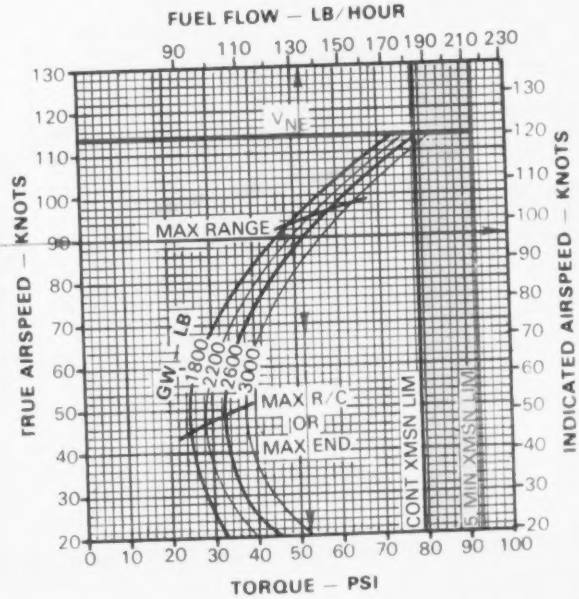
ENTER TRUE AIRSPEED HERE
READ TORQUE, FUEL FLOW, AND IAS ON EACH ADJACENT ALTITUDE AND/OR FAT, THEN INTERPOLATE BETWEEN ALTITUDE AND FAT

ALTITUDE, FEET	SEA LEVEL	2000 FEET	1000 FEET
FAT, °C	30	30	30
TORQUE, PSI	54.5	52.5	53.5
FUEL FLOW, LB/HR	140	134	137
IAS, KNOTS	99	96	97.5

METHOD 2 (SIMPLEST)

USE NEXT HIGHEST ALTITUDE AND/OR TEMPERATURE (2000 FEET, -30 C)
ENTER TRUE AIRSPEED HERE
MOVE RIGHT TO GROSS WEIGHT
MOVE DOWN AND READ CALIBRATED TORQUE = 52.5 PSI
MOVE UP AND READ FUEL FLOW = 134 LB/HR
MOVE RIGHT, READ IAS = 96 KNOTS


PRESSURE ALTITUDE — SEA LEVEL


PRESSURE ALTITUDE — 2000 FEET

DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO 68-30, SEPTEMBER 1970

Figure 7-6. Cruise Chart A (Sheet 1 of 13)

CRUISE
OH-58A
T63-A-700

CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
103% RPM

FAT = – 30°C

EXAMPLE B

WANTED

SPEED FOR MAXIMUM RANGE

TORQUE REQUIRED AND FUEL FLOW AT MAXIMUM RANGE

SPEED FOR MAXIMUM ENDURANCE

KNOWN

CLEAN CONFIGURATION, FAT = –30°C

PRESSURE ALTITUDE = 4000 FEET,
AND GROSS WEIGHT = 2600 LB

METHOD

LOCATE (–30°C FAT, 4000 FEET) CHART

FIND THE INTERSECTION OF 2600 LB GROSS WEIGHT LINE WITH THE MAXIMUM RANGE LINE

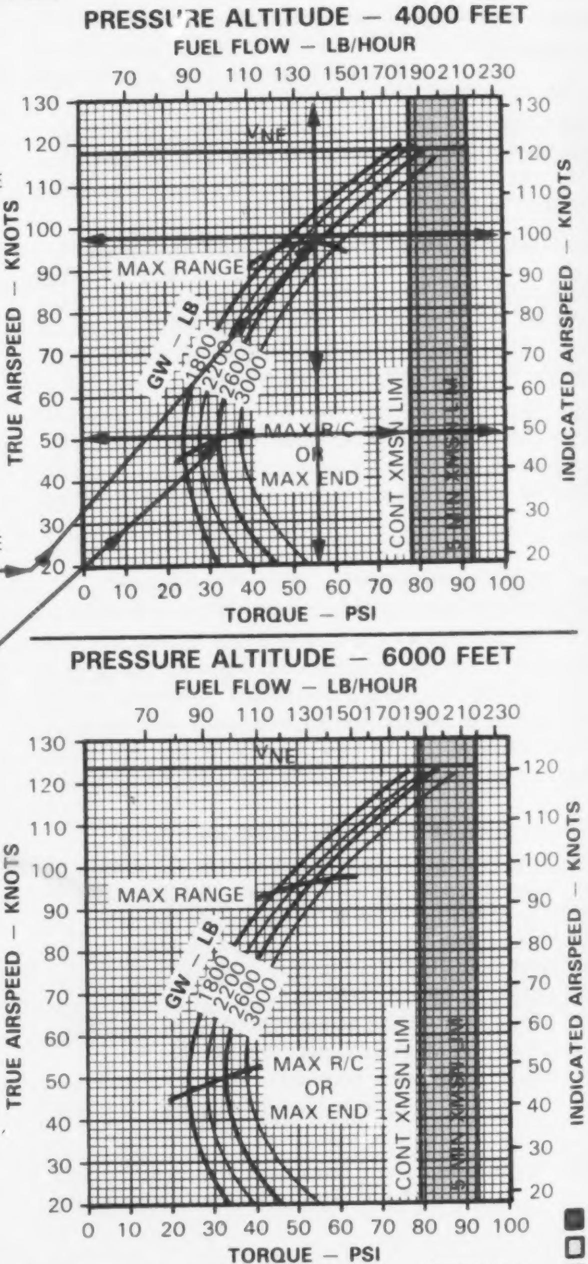
TO READ SPEED FOR MAXIMUM RANGE
MOVE LEFT, READ TAS = 97 KNOTS AND
MOVE RIGHT, READ IAS = 99 KNOTS

TO READ FUEL FLOW REQUIRED
MOVE UP, READ FUEL FLOW = 138 LB/HR

TO READ TORQUE REQUIRED
MOVE DOWN, READ TORQUE = 56.5 PSI

FIND INTERSECTION OF 2600 LB GROSS WEIGHT LINE WITH THE MAXIMUM ENDURANCE LINE

TO READ SPEED FOR MAXIMUM ENDURANCE
MOVE LEFT, READ TAS = 50 KNOTS AND
MOVE RIGHT, READ IAS = 48 KNOTS



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

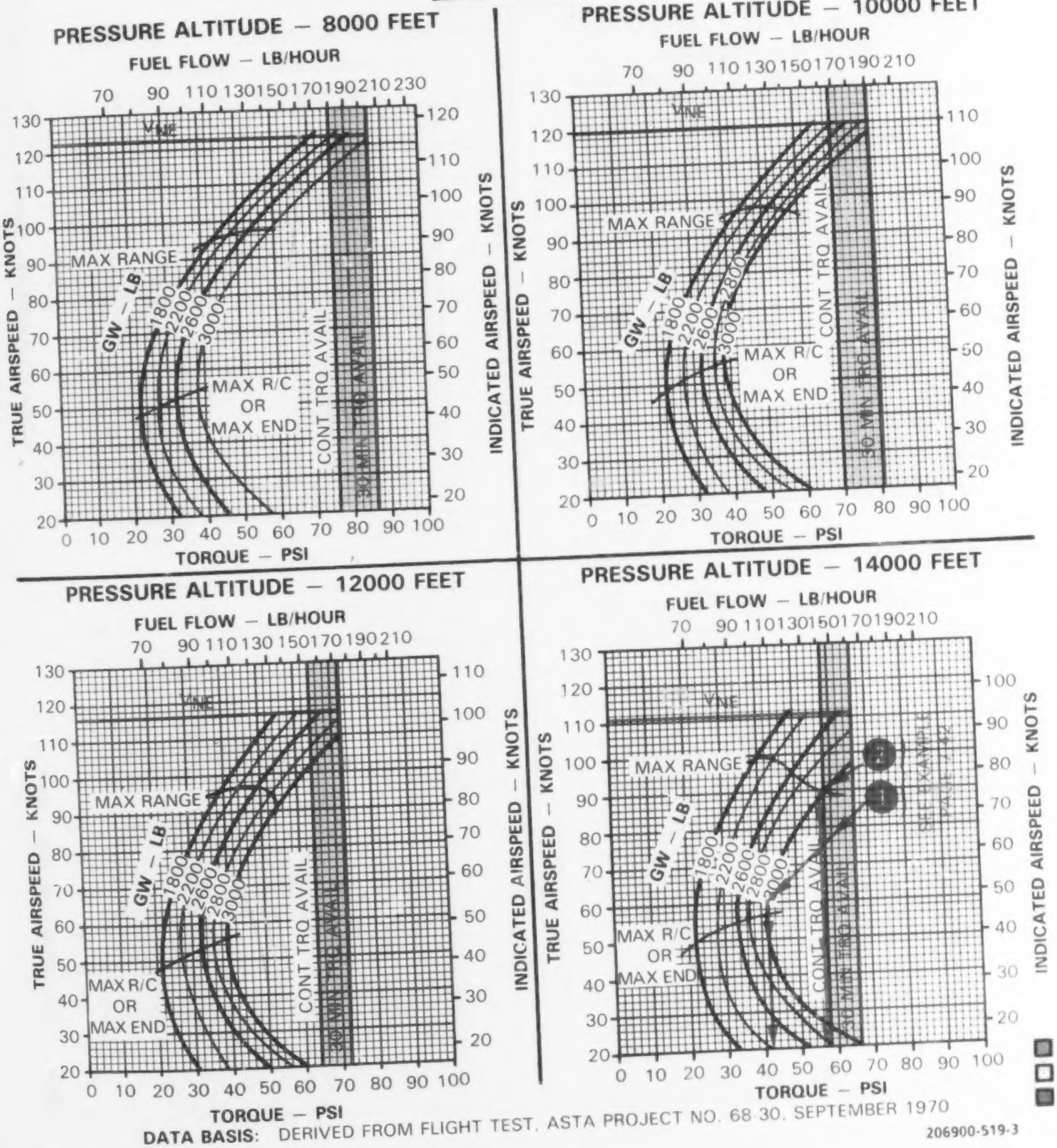
206900-519-2

Figure 7-6. Cruise Chart A (Sheet 2 of 13)

CRUISE
OH-58A
T63-A-700

CRUISE
PRESSURE ALTITUDE — 8000 FEET TO 14000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
103% RPM

FAT = – 30°C



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

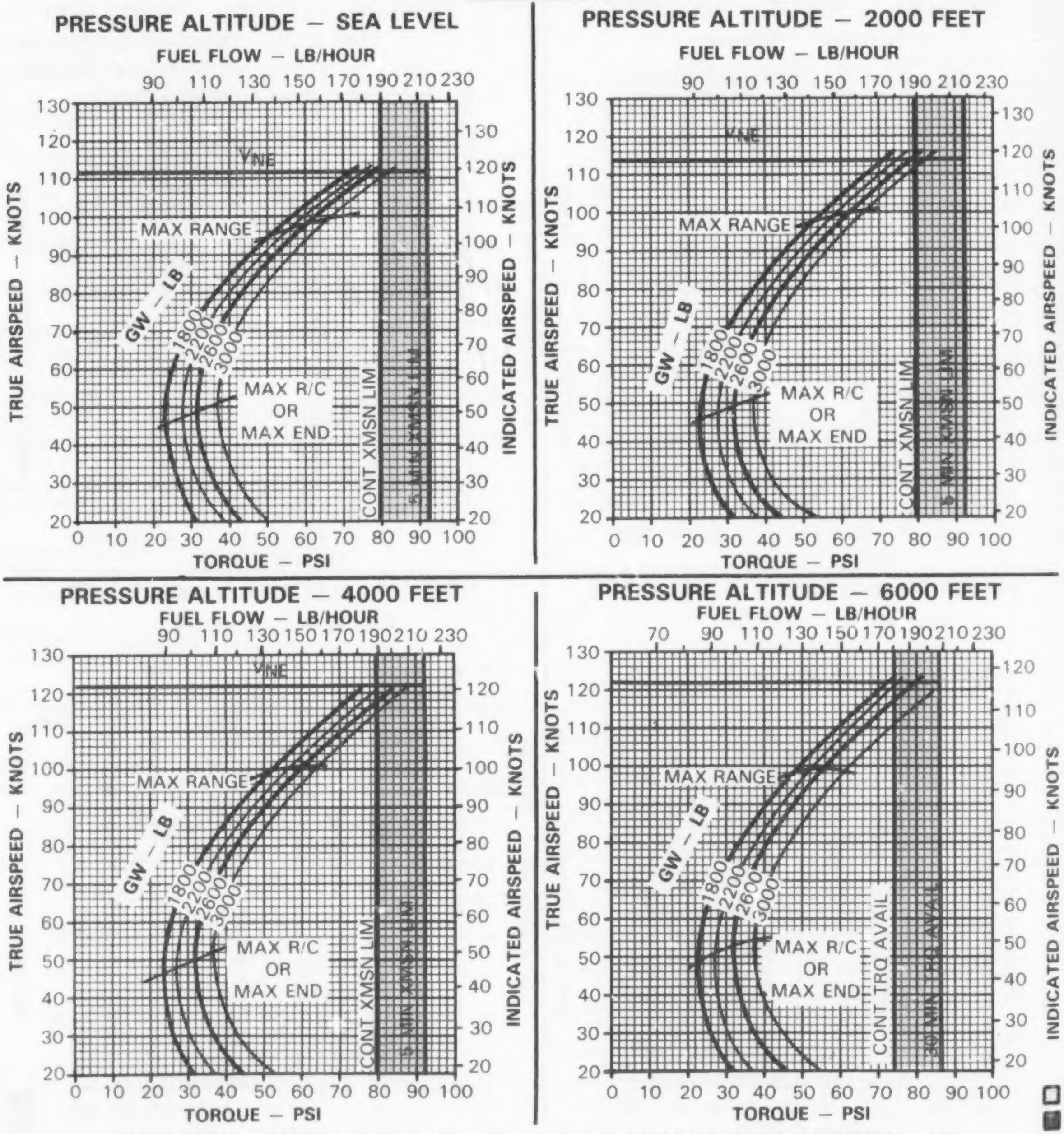
Figure 7-6. Cruise Chart **A** (Sheet 3 of 13)

CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 6000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
103% RPM

CRUISE
OH-58A
T63-A-700

FAT = – 15°C



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-519-4

Figure 7-6. Cruise Chart A (Sheet 4 of 13)

CRUISE
OH-58A
T63-A-700

CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 14000 FEET

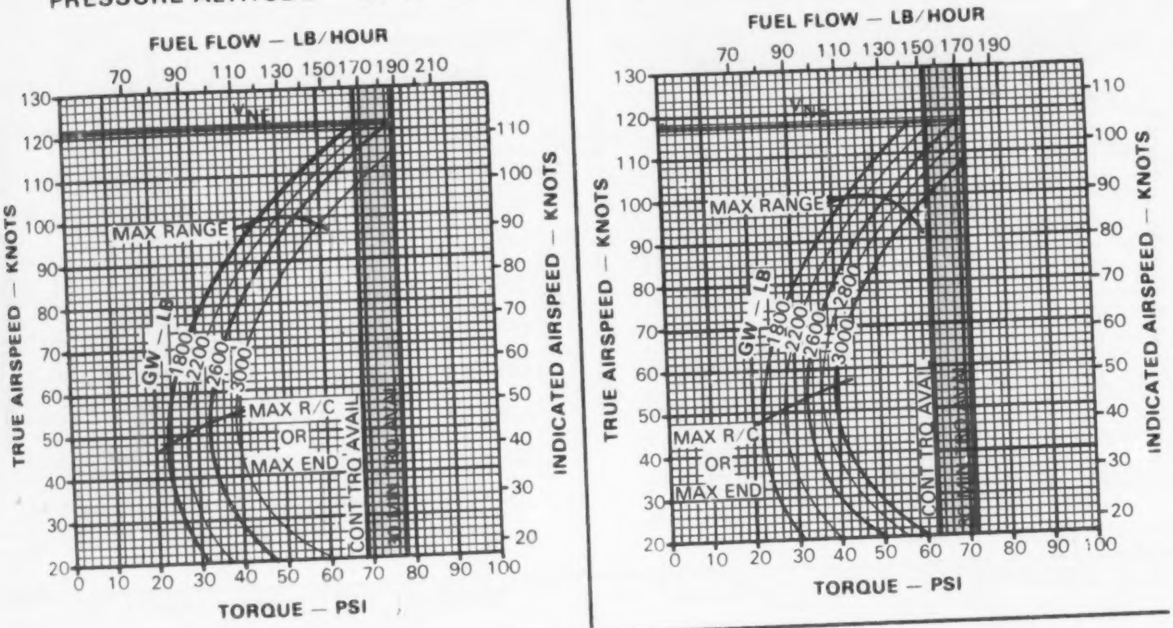
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE

103% RPM

FAT = -15°C

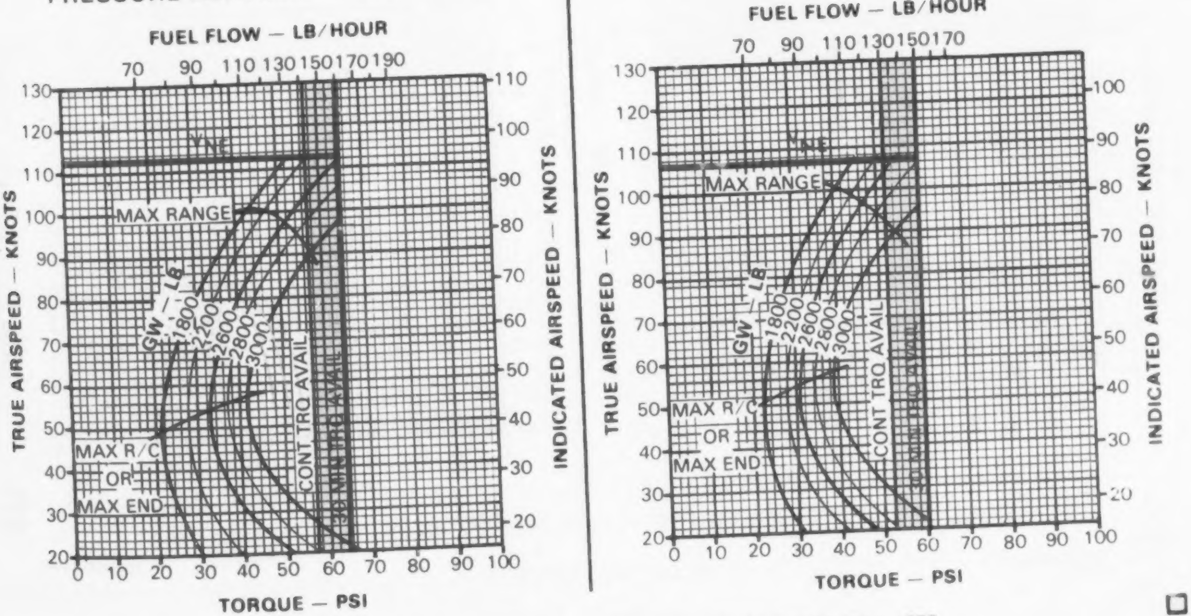
PRESSURE ALTITUDE — 8000 FEET

PRESSURE ALTITUDE — 10000 FEET



PRESSURE ALTITUDE — 12000 FEET

PRESSURE ALTITUDE — 14000 FEET



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

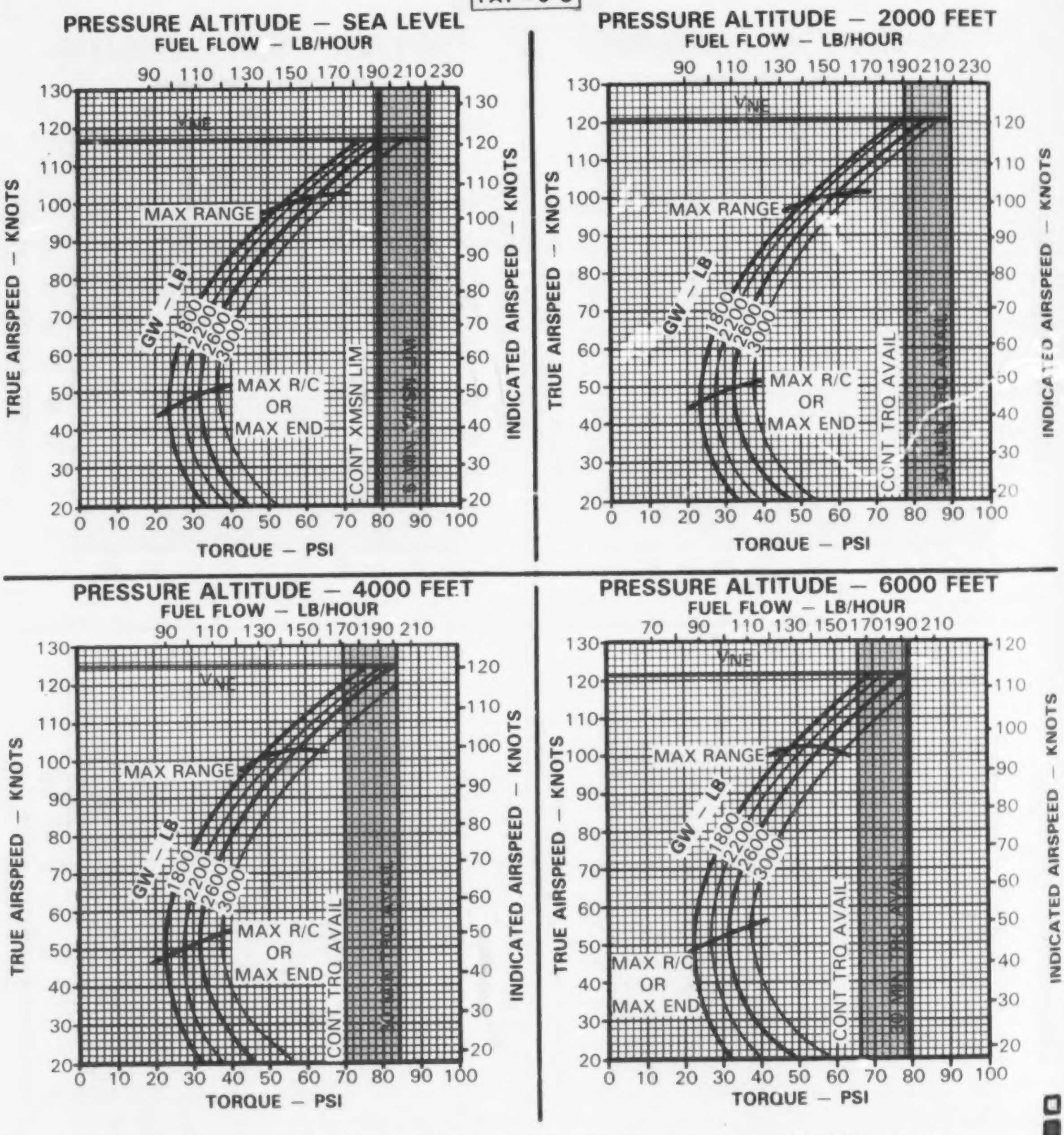
Figure 7-6. Cruise Chart A (Sheet 5 of 13)

CRUISE
OH-58A
T63-A-700

CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 6000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
103% RPM

FAT = 0°C



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-519-6

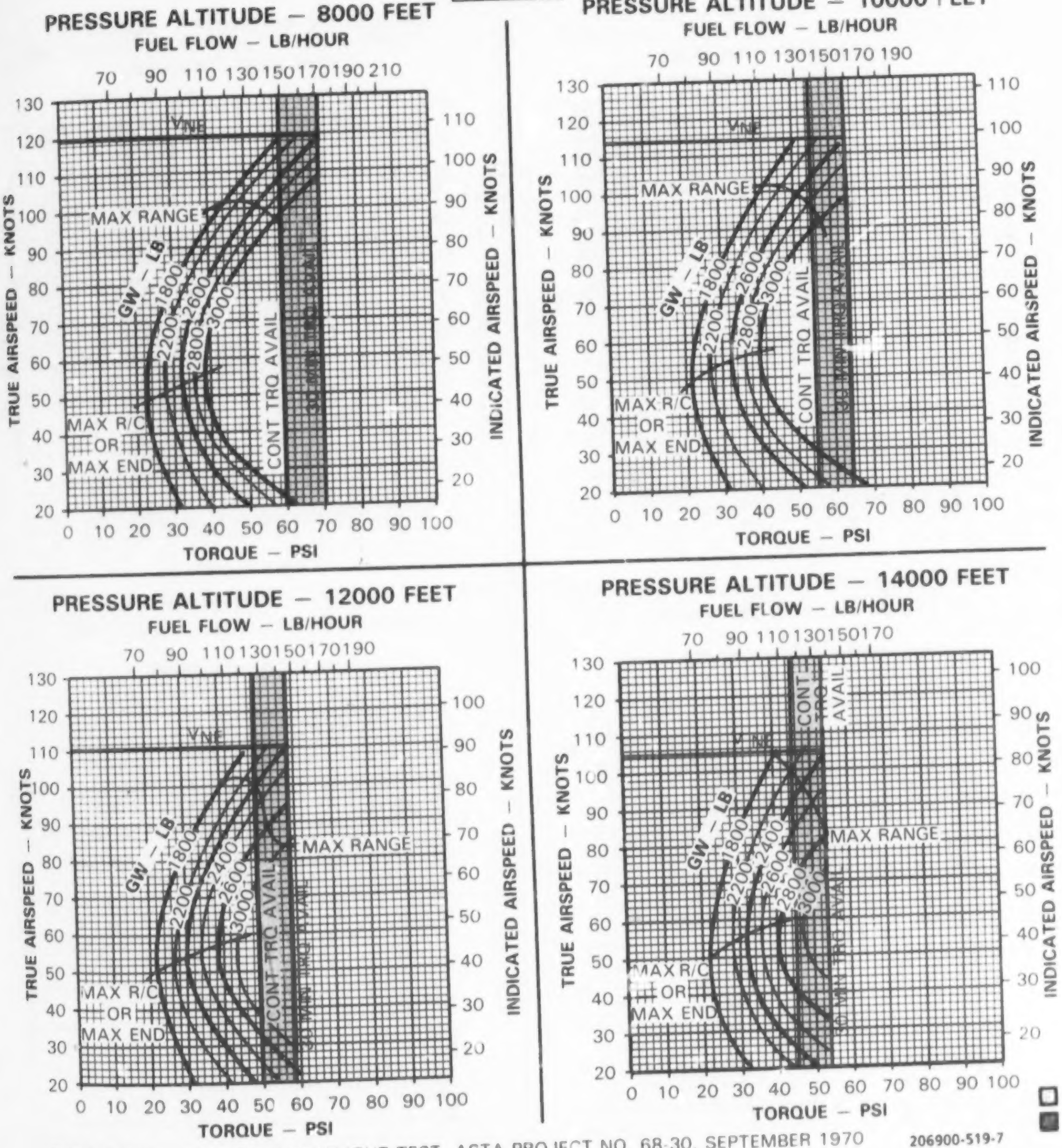
Figure 7-6. Cruise Chart A (Sheet 6 of 13)

CRUISE
OH-58A
T63-A-700

CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 14000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
103% RPM

FAT = 0°C



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-519-7

Figure 7-6. Cruise Chart A (Sheet 7 of 13)

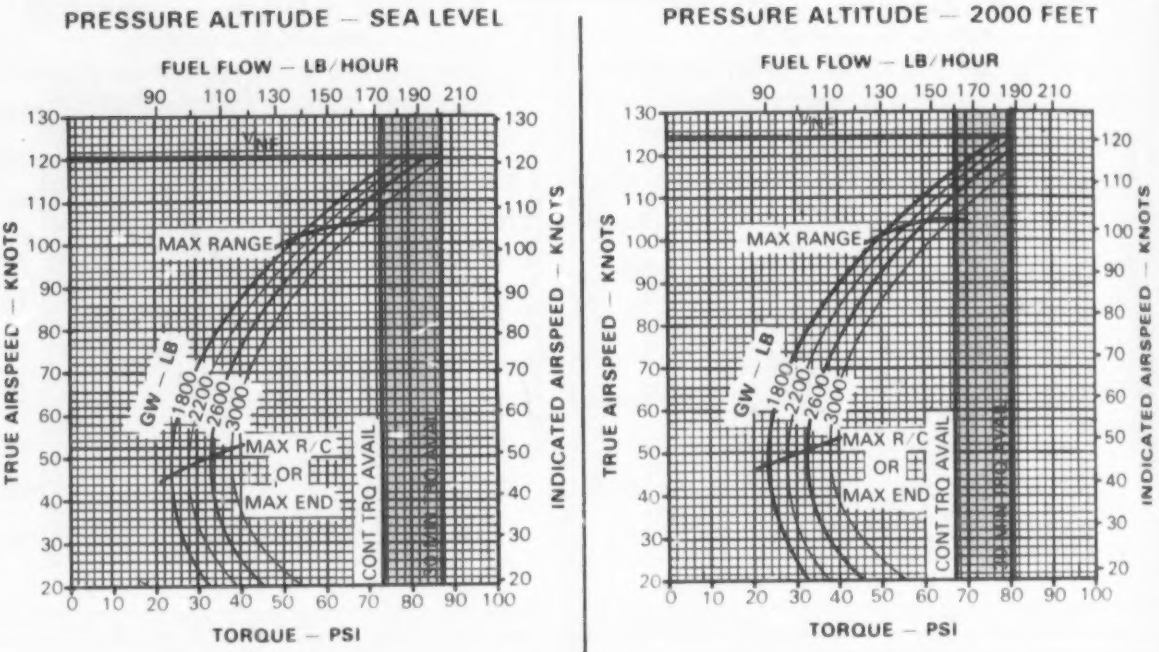
CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 6000 FEET

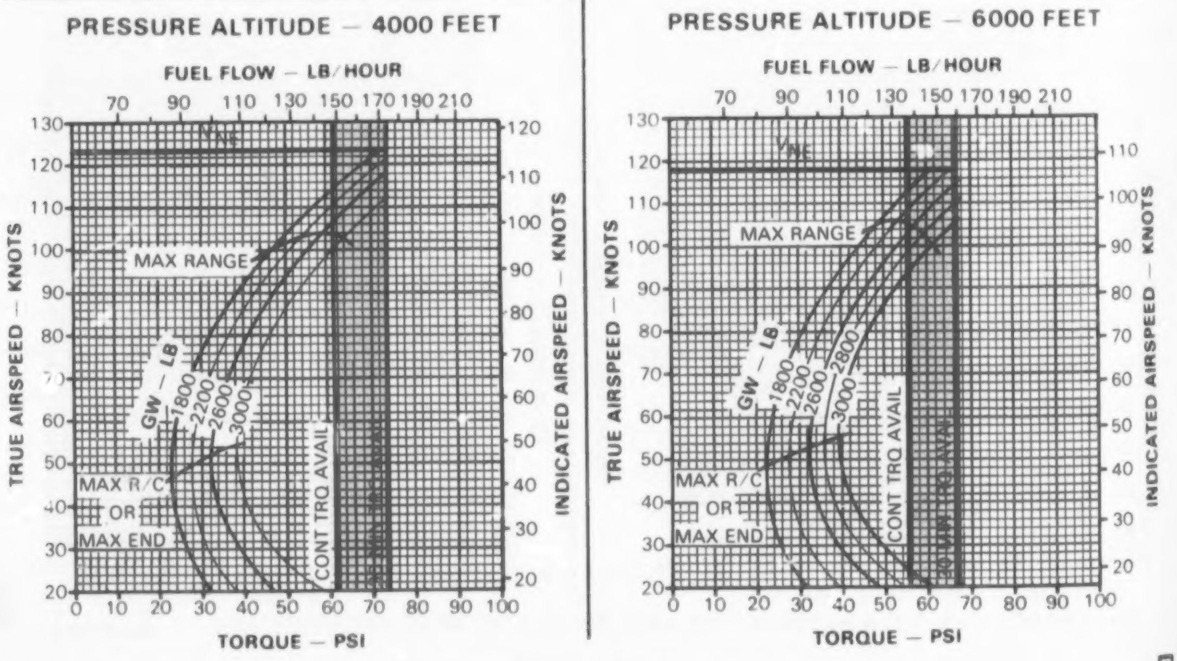
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE

103% RPM

FAT = +15°C


PRESSURE ALTITUDE — SEA LEVEL

PRESSURE ALTITUDE — 2000 FEET


PRESSURE ALTITUDE — 4000 FEET

PRESSURE ALTITUDE — 6000 FEET

DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO 68-30, SEPTEMBER 1970

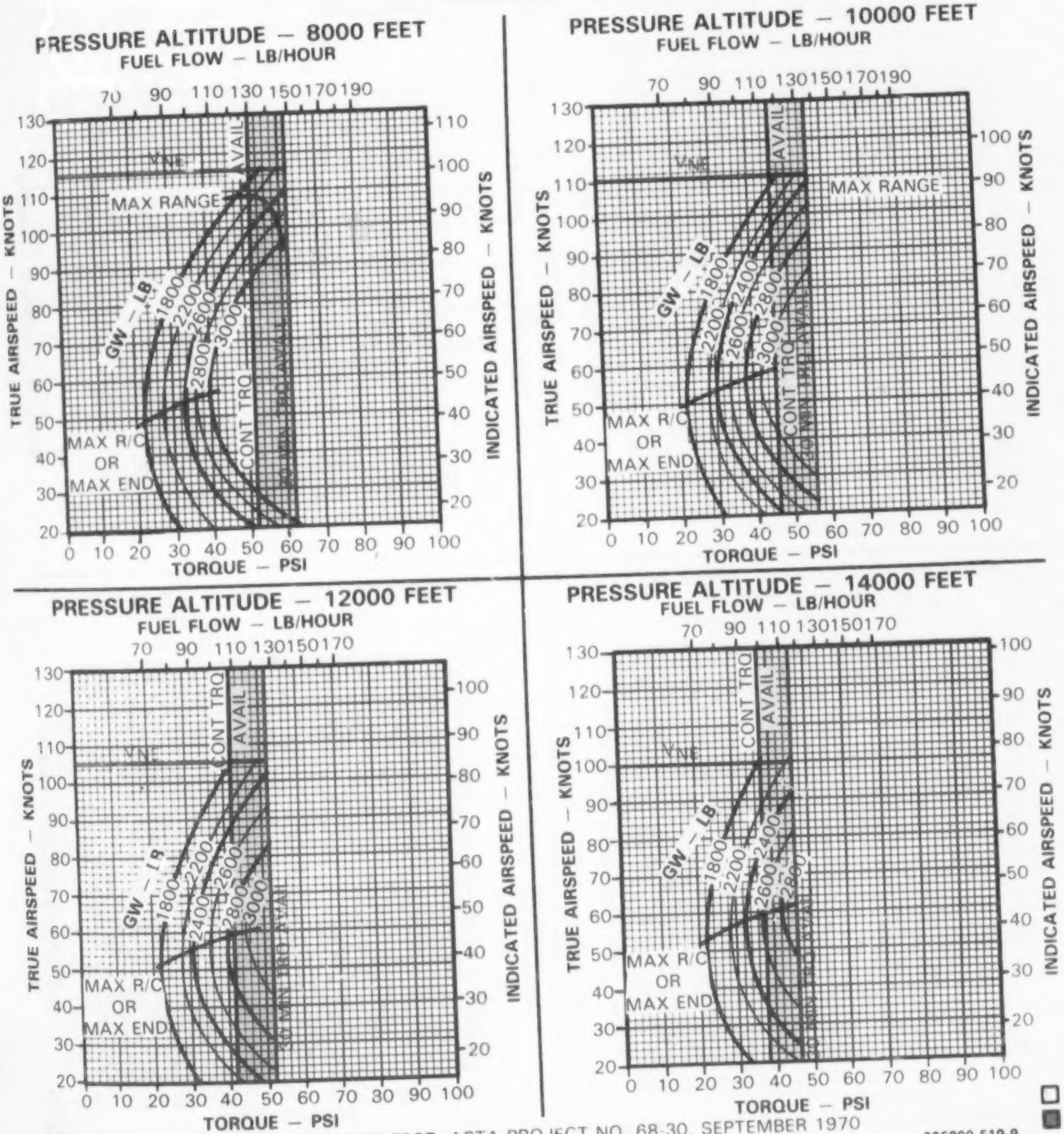
Figure 7-8. Cruise Chart A (Sheet 8 of 13)

CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 14000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
103% RPM

FAT = +15°C

CRUISE
OH-58A
T63-A-700



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

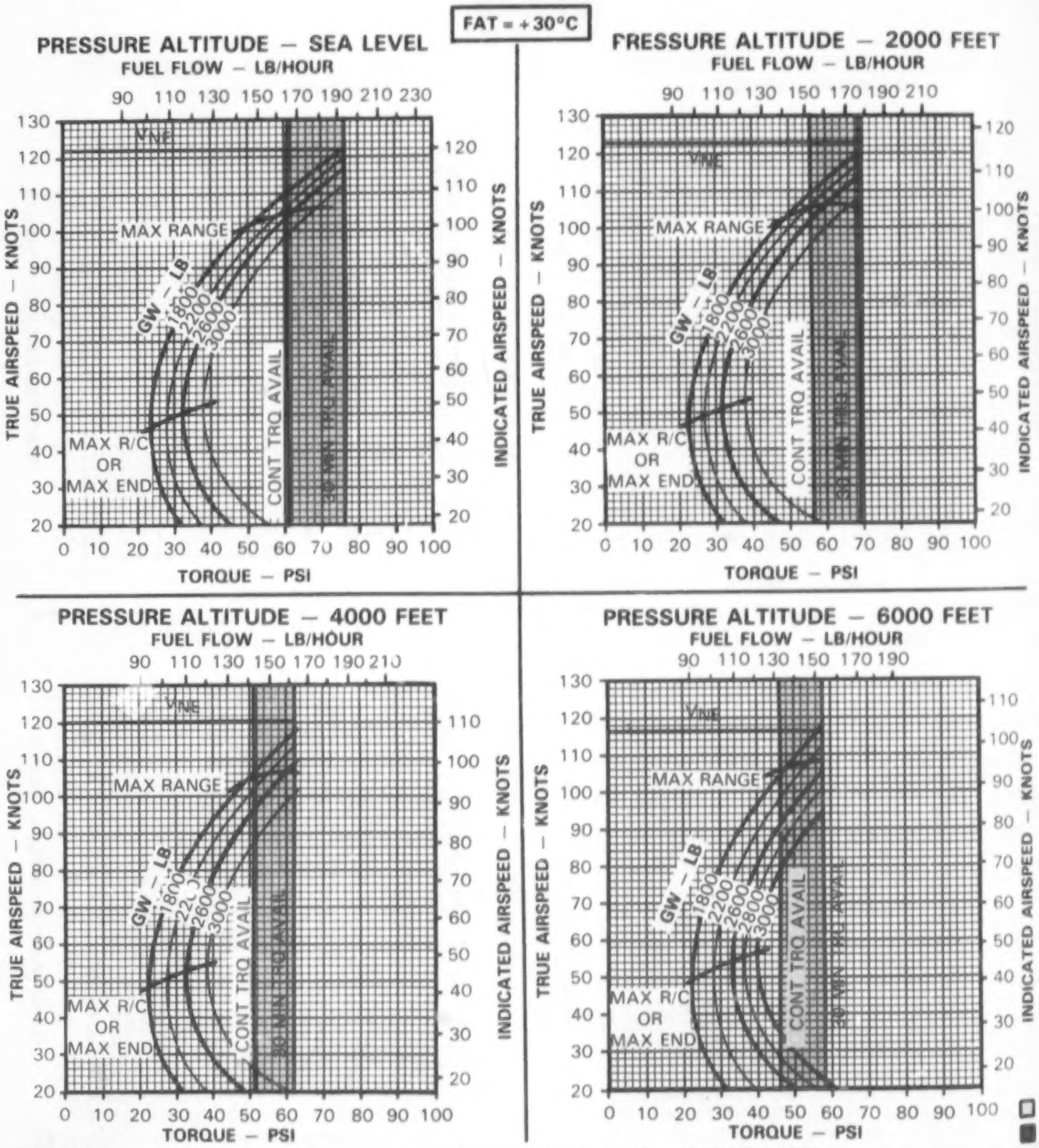
206900-519-9

Figure 7-6. Cruise Chart A (Sheet 9 of 13)

■
□

CRUISE
PRESSURE ALTITUDE — SEA LEVEL TO 6000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
103% RPM

CRUISE
OH-58A
T63-A-700



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-519-10

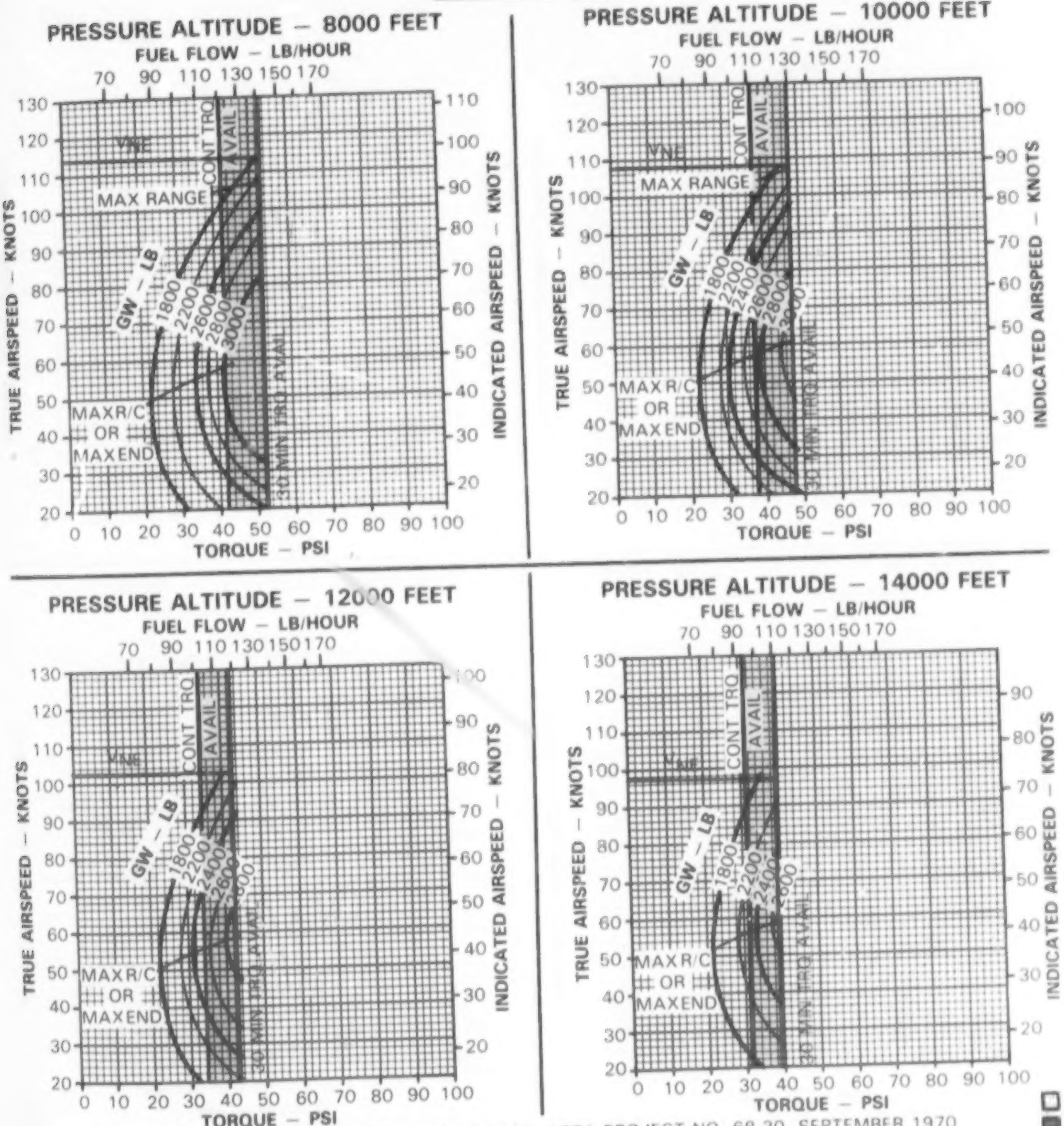
Figure 7-6. Cruise Chart A (Sheet 10 of 13)

CRUISE
OH-58A
T63-A-700

CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 14000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
103% RPM

FAT = +30°C



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-519-11

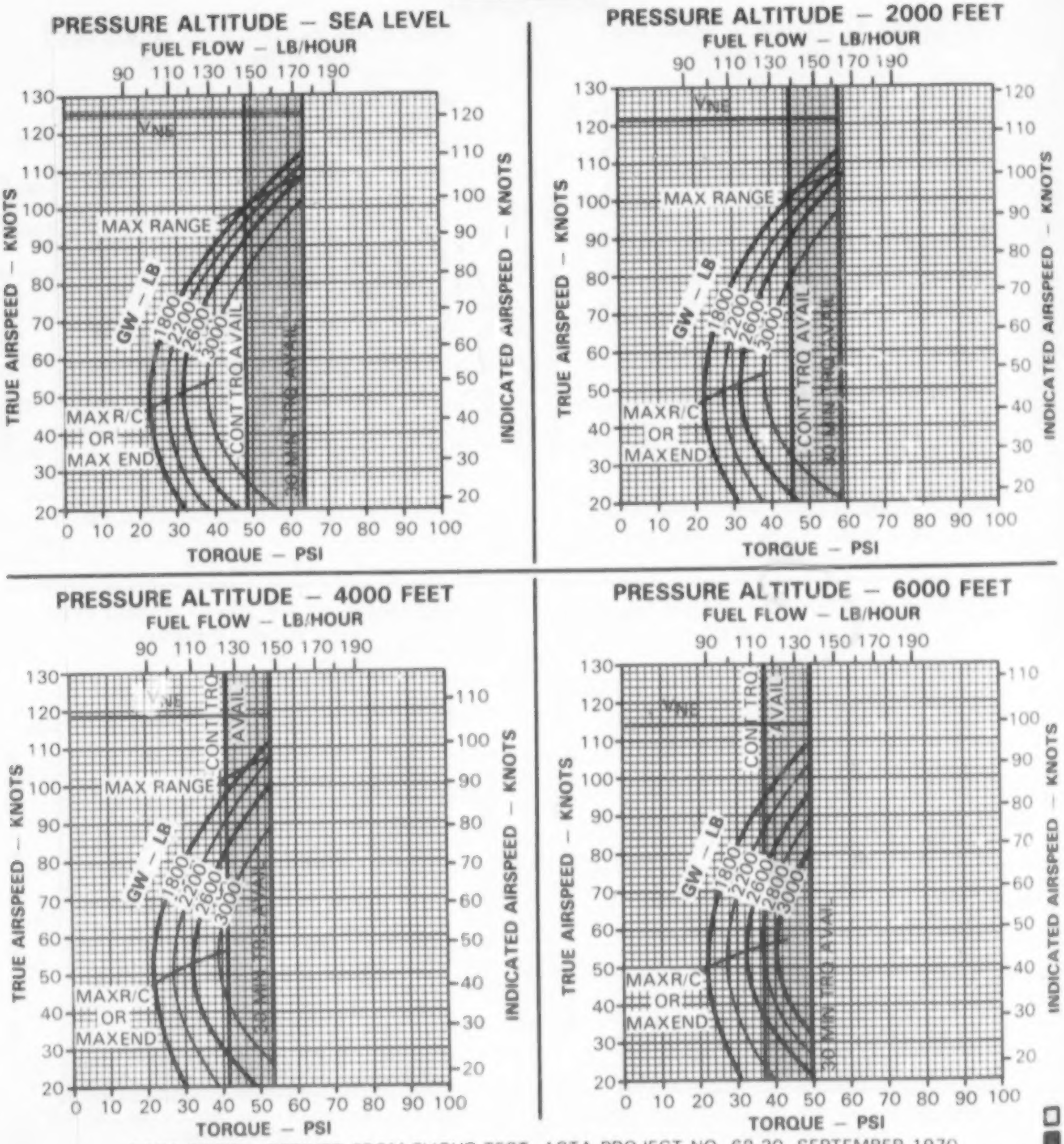
Figure 7-6. Cruise Chart **A** (Sheet 11 of 13)

CRUISE
OH-58A
T63-A-700

CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 6000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
103% RPM

FAT = + 45°C



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-519-12

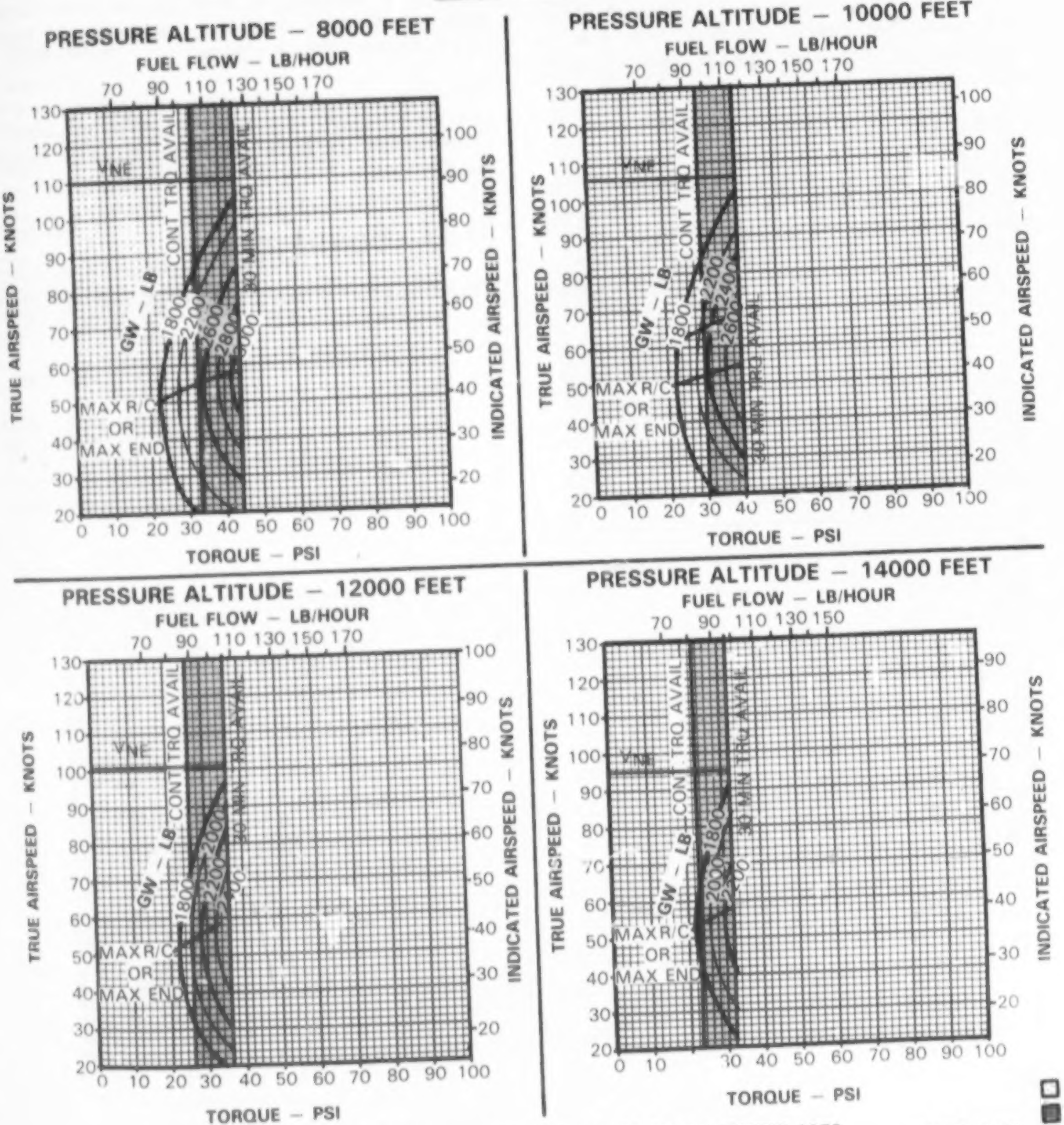
Figure 7-6. Cruise Chart A (Sheet 12 of 13)

CRUISE
OH-58A
T63-A-700

CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 14000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
103% RPM

FAT = +45°C



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DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

Figure 7-6. Cruise Chart A (Sheet 13 of 13)

SECTION VII. DRAG A

7-25. DESCRIPTION.

The drag chart (figure 7-7) shows the torque change required for flight due to drag area change as a result of external configuration changes. Note that the figure shows drag area change due to specific configurations.

7-26. USE OF CHART.

The primary use of the chart is illustrated by the example. To determine the change in torque it is necessary to know the drag area change, the true airspeed, the pressure altitude and the free air temperature. Enter at the known drag area change, move right to TAS, move down to pressure altitude, move left to FAT, then move down and read change in torque. In addition, by entering the chart in the opposite direction, drag area change may be found from a known torque change.

This chart is used to adjust cruise charts (figure 7-6, sheets 1 through 13) for appropriate torque and fuel flow due to equivalent flat plate drag area change (ΔF).

7-27. CONDITIONS.

The drag chart is based upon 103% rpm.

DRAG

HOVER
OH-58A
T63-A-700

EXAMPLE

WANTED

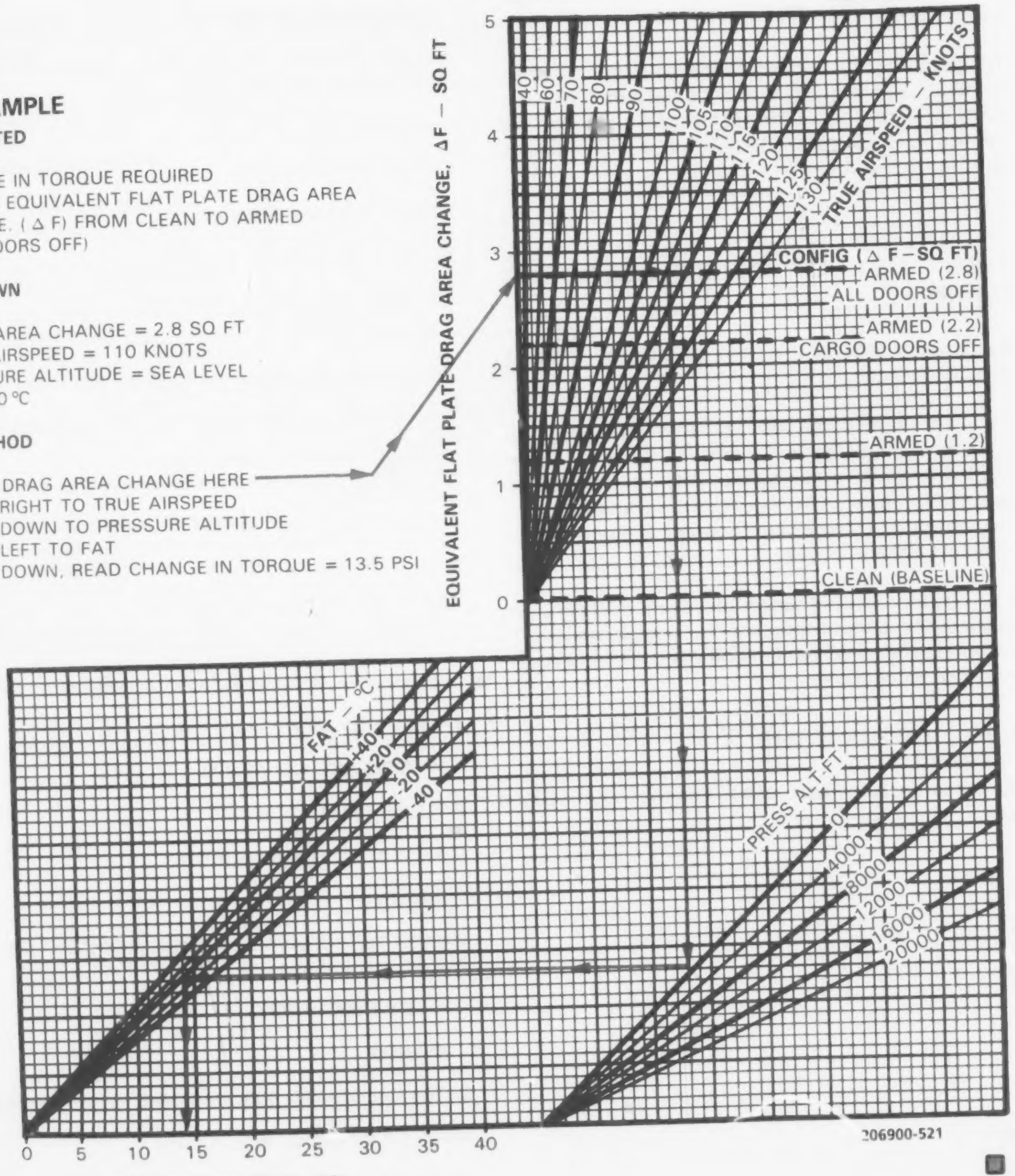
CHANGE IN TORQUE REQUIRED
DUE TO EQUIVALENT FLAT PLATE DRAG AREA
CHANGE. (Δ F) FROM CLEAN TO ARMED
(ALL DOORS OFF)

KNOWN

DRAG AREA CHANGE = 2.8 SQ FT
TRUE AIRSPEED = 110 KNOTS
PRESSURE ALTITUDE = SEA LEVEL
FAT = 0 °C

METHOD

ENTER DRAG AREA CHANGE HERE
MOVE RIGHT TO TRUE AIRSPEED
MOVE DOWN TO PRESSURE ALTITUDE
MOVE LEFT TO FAT
MOVE DOWN, READ CHANGE IN TORQUE = 13.5 PSI



CHANGE IN TORQUE - PSI

DATA BASIS: CALCULATED DATA

Figure 7-7. Drag Chart **A**

SECTION VIII. CLIMB — DESCENT A

7-28. DESCRIPTION — CLIMB-DESCENT CHART.

The grid of the climb-descent chart (figure 7-8) shows the change in torque (above or below torque required for level flight under the same gross weight, and atmospheric conditions) to obtain a given rate of climb or descent.

7-29. USE OF CLIMB—DESCENT CHART.

The primary uses of the chart are illustrated by the chart examples.

a. The torque change obtained from the grid scale must be added to the torque required for level flight (for climb) — or subtracted from the torque required for level flight (for descent) — obtained from the appropriate cruise chart in order to obtain a total climb or descent torque.

b. By entering the bottom of the grid with a known torque change, moving upward to the gross weight, and left to the corresponding rate of climb or descent may also be obtained.

7-30. CONDITIONS.

The climb-descent chart is based on the use of 103% rpm.

EXAMPLE

WANTED (SEE FIGURE 7-6)

EXCESS TORQUE AVAILABLE FOR CLIMB AT MAXIMUM CONTINUOUS POWER

KNOWN

CLEAN CONFIGURATION

GROSS WEIGHT = 3000 LB

FAT = -30°C

PRESSURE ALTITUDE = 14000 FEET

METHOD

LOCATE CHART (FIGURE 7-6, SHEET 3)

FIND INTERSECTION OF 3000 LB GROSS WEIGHT

LINE WITH THE MAXIMUM RATE OF CLIMB LINE → ①

MOVE DOWN, READ TORQUE REQUIRED = 42 PSI

FIND INTERSECTION OF 3000 LB GROSS WEIGHT

LINE WITH CONTINUOUS TORQUE AVAILABLE LINE → ②

MOVE DOWN, READ TORQUE AVAILABLE = 59 PSI

EXCESS TORQUE AVAILABLE = (59 -42) = 17 PSI

WANTED (SEE FIGURE 7-8)

RATE OF CLIMB AT 70 KIAS

MAXIMUM CONTINUOUS POWER

KNOWN

EXCESS TORQUE AVAILABLE (FROM EXAMPLE ON FIGURE 7-6, SHEET 1) = 17 PSI

GROSS WEIGHT = 3000 LB

METHOD

ENTER CALIBRATED TORQUE SCALE HERE → ③

MOVE UP TO GROSS WEIGHT LINE

MOVE LEFT TO RATE OF CLIMB OR DESCENT SCALE
READ RATE OF CLIMB = 525 FT/MIN

CLIMB — DESCENT
103% RPM

CLIMB — DESCENT
OH-58A
T63-A-700

EXAMPLE

WANTED

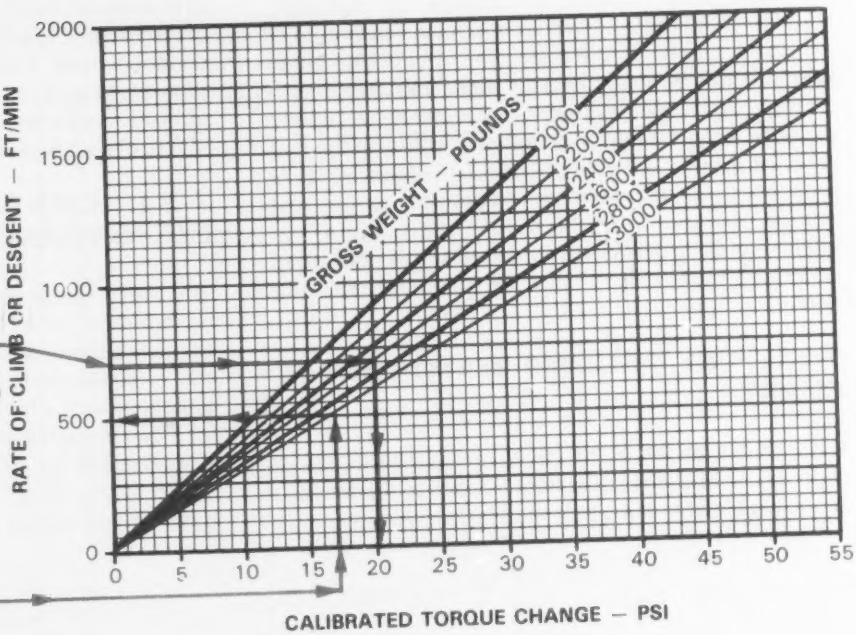
CALIBRATED TORQUE CHANGE FOR DESIRED R/C OR R/D

KNOWN OR ESTIMATED

GROSS WEIGHT = 2600 LB
DESIRED R/C = 700 FT/MIN

METHOD

ENTER R/C HERE
MOVE RIGHT TO GROSS WEIGHT
MOVE DOWN, READ CALIBRATED TORQUE CHANGE = 20 PSI



REMARK: TORQUE CHANGE IS THE DIFFERENCE BETWEEN THE TORQUE USED DURING THE CLIMB OR DESCENT AND THE TORQUE REQUIRED FOR LEVEL FLIGHT AT THE SAME CONDITIONS (ALTITUDE, GROSS WEIGHT, AIRSPEED, CONFIGURATION, ETC)

DATA BASIS: DERIVED FROM FLIGHT TEST, USA ASTA 68-30, SEPTEMBER 1970 AND CALCULATED DATA

206900-522

Figure 7-8. Climb — Descent Chart A

7-31. DESCRIPTION — CLIMB PERFORMANCE CHARTS.

The climb performance charts (figure 7-9) represent a synthesis of the cruise charts to ease estimation of the climb portion of the flight plan. The charts show relationships between gross weight, initial and final altitude and temperatures, and time to climb, distance covered while climbing, and fuel expended while climbing. The chart (figure 7-9, sheet 1 of 2) is presented for climbing at maximum torque (30 minute operation) and the second chart (figure 7-9, sheet 2 of 2) is presented for (continuous operation) climbing. Both charts may be used for all drag configurations.

7-32. USE OF CLIMB PERFORMANCE CHARTS.

Enter at the top left at the known gross weight, move right to the initial altitude, move down to the free air temperature at that altitude, and move left and record time, distance, and fuel consumed for that altitude. Enter again at the gross weight, move right to the final altitude, move down to the free air temperature at that altitude, and move right and record the time, distance, and fuel for that altitude. Subtract the time, distance, and fuel values of the initial altitude-temperature condition from those of the final altitude-temperature condition to find the time to climb, distance covered and fuel used while climbing.

7-33. CONDITIONS — CLIMB PERFORMANCE CHARTS.

The charts represent climb at optimum condition, that is minimum power required and torque available. Climb is assumed to be at 50 knots IAS as this is near the airspeed for maximum rate of climb at most atmospheric conditions. Warmup and taxi fuel are not included in fuel flow calculations. Climb performance is calculated for 103% rpm. The charts are based upon a no-wind condition, therefore, distance traveled will not be valid when winds are present.

CLIMB PERFORMANCE
(MAXIMUM TORQUE AVAILABLE — 30 MINUTE OPERATION)
103% RPM CLIMB AT 50 KIAS

CLIMB
OH-58A
T63-A-700

EXAMPLE

WANTED

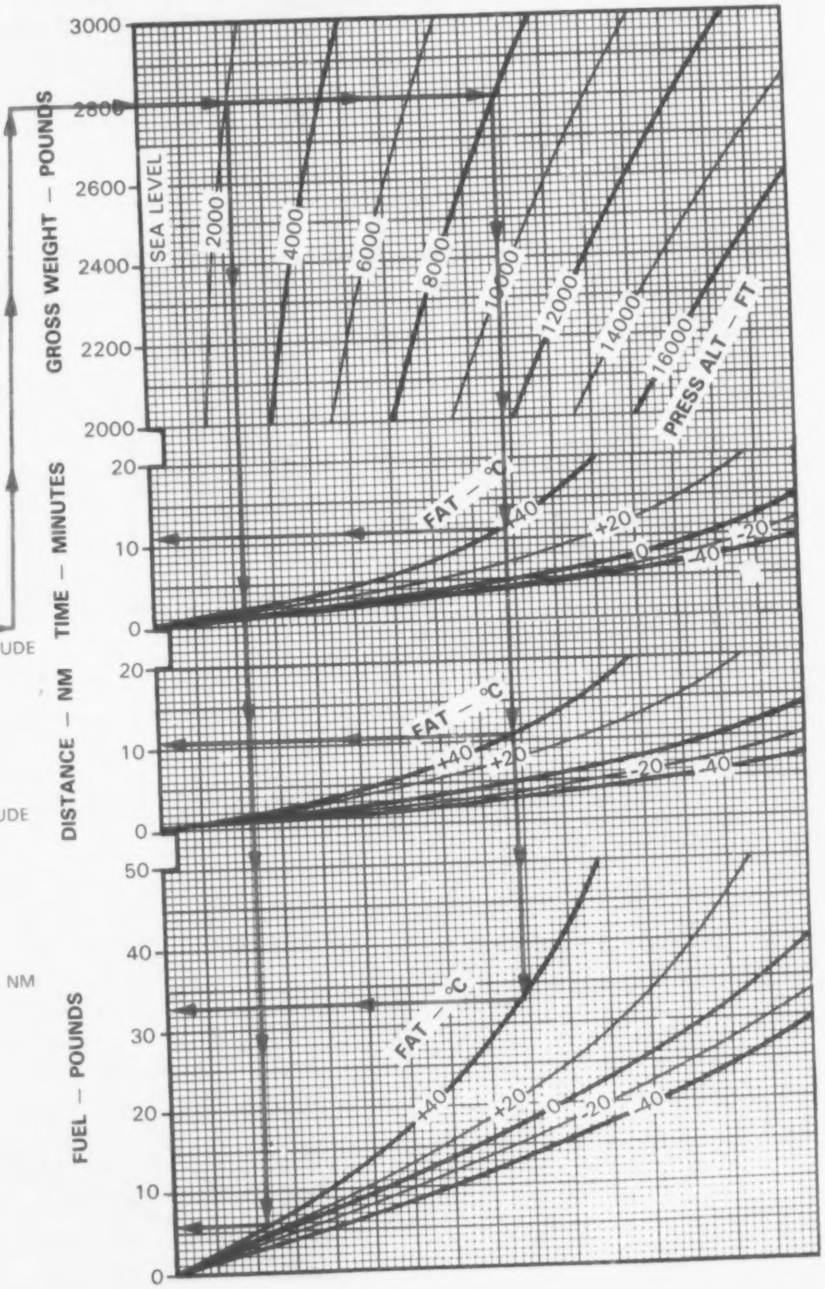
MAXIMUM POWER
TIME TO CLIMB
DISTANCE TRAVELED
FUEL USED

KNOWN

GROSS WEIGHT = 2800 LBS
INITIAL PRESSURE ALTITUDE = 2000 FT
FINAL PRESSURE ALTITUDE = 8000 FT
INITIAL FAT = 40°C
FINAL FAT ESTIMATED AT 40°C

METHOD

ENTER GROSS WEIGHT HERE
MOVE RIGHT TO INITIAL PRESSURE ALTITUDE
MOVE DOWN TO INITIAL FAT ON
TIME, DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:
  TIME = 1.7 MIN
  DISTANCE = 1.8 NM
  FUEL = 6 LB
REENTER AT SAME GROSS WEIGHT
MOVE RIGHT TO FINAL PRESSURE ALTITUDE
MOVE DOWN TO FINAL FAT, ON TIME,
DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:
  TIME = 12 MIN
  DISTANCE = 10.9 NM
  FUEL = 33 LB
TIME TO CLIMB = (12 - 1.7) = 10.3 MIN
DISTANCE COVERED = (10.9 - 1.8) = 9.1 NM
FUEL USED = (33 - 6) = 27 LB



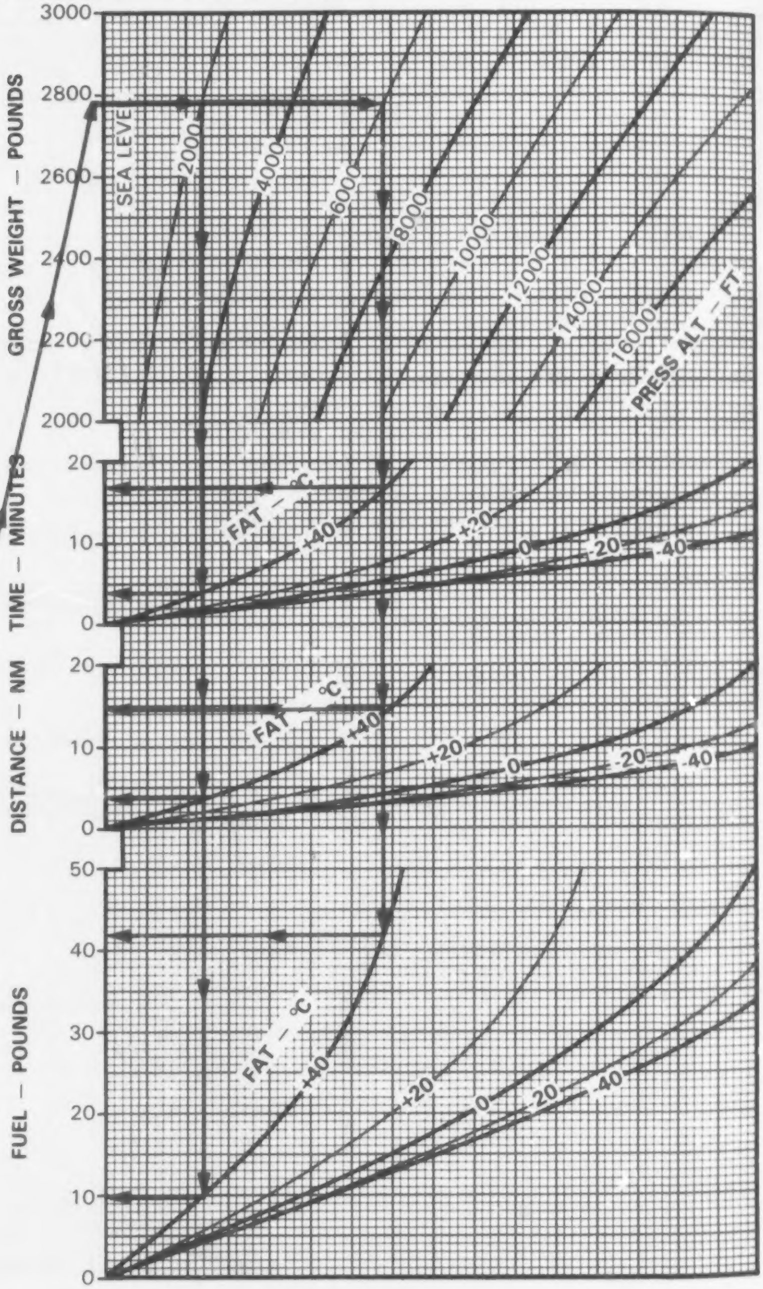
DATA BASIS: DERIVED FROM FLIGHT TEST, USA ASTA 68-30 SEPTEMBER 1970

206900-523-1

Figure 7-9. Climb Performance A (Sheet 1 of 2)

CLIMB
OH-58A
T63-A-700

CLIMB PERFORMANCE
(CONTINUOUS OPERATION)
103% RPM CLIMB AT 50 KIAS



EXAMPLE

WANTED

CONTINUOUS POWER
TIME TO CLIMB
DISTANCE TRAVELED
FUEL USED

KNOWN

GROSS WEIGHT = 2780 LBS
INITIAL PRESSURE ALTITUDE = 2000 FT
FINAL PRESSURE ALTITUDE = 6000 FT
INITIAL FAT = 40°C
FINAL FAT ESTIMATED AT 40°C

METHOD

ENTER GROSS WEIGHT HERE
MOVE RIGHT TO INITIAL PRESSURE ALTITUDE
MOVE DOWN TO INITIAL FAT ON
TIME, DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:
TIME = 3.7 MIN
DISTANCE = 3.3 NM
FUEL = 10 LB
REENTER AT SAME GROSS WEIGHT
MOVE RIGHT TO FIANL PRESSURE ALTITUDE
MOVE DOWN TO FINAL FAT, ON TIME,
DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:
TIME = 16.3 MIN
DISTANCE = 14.4 NM
FUEL = 41.7 LB
TIME TO CLIMB =(16.3 - 3.7) = 12.6 MIN
DISTANCE COVERED =(14.4 - 3.3) = 11.1 NM
FUEL USED = (41.7 - 10) = 31.7 LB

DATA BASIS: DERIVED FROM FLIGHT TEST, USA ASTA 68-30 SEPTEMBER 1970

206900-523-2

Figure 7-9. Climb Performance A (Sheet 2 of 2)

SECTION IX. IDLE FUEL FLOW A

7-34. DESCRIPTION.

The idle fuel flow chart (figure 7-10) shows the fuel flow at flight idle and at ground idle (flat pitch) with 103% rpm.

7-35. USE OF CHART.

The primary use of the chart is illustrated by the example. To determine the idle flow, it is necessary to know the idle condition, pressure altitude, and free air temperature. Enter at the pressure altitude, move right to FAT in appropriate grid, then move down and read fuel flow on the scale corresponding to the condition. Refer to the cruise charts to obtain fuel flow for cruise power conditions.

7-36. CONDITIONS.

This chart is based upon the use of JP-4 or JP-5 fuel and 103% rpm.

EXAMPLE

WANTED

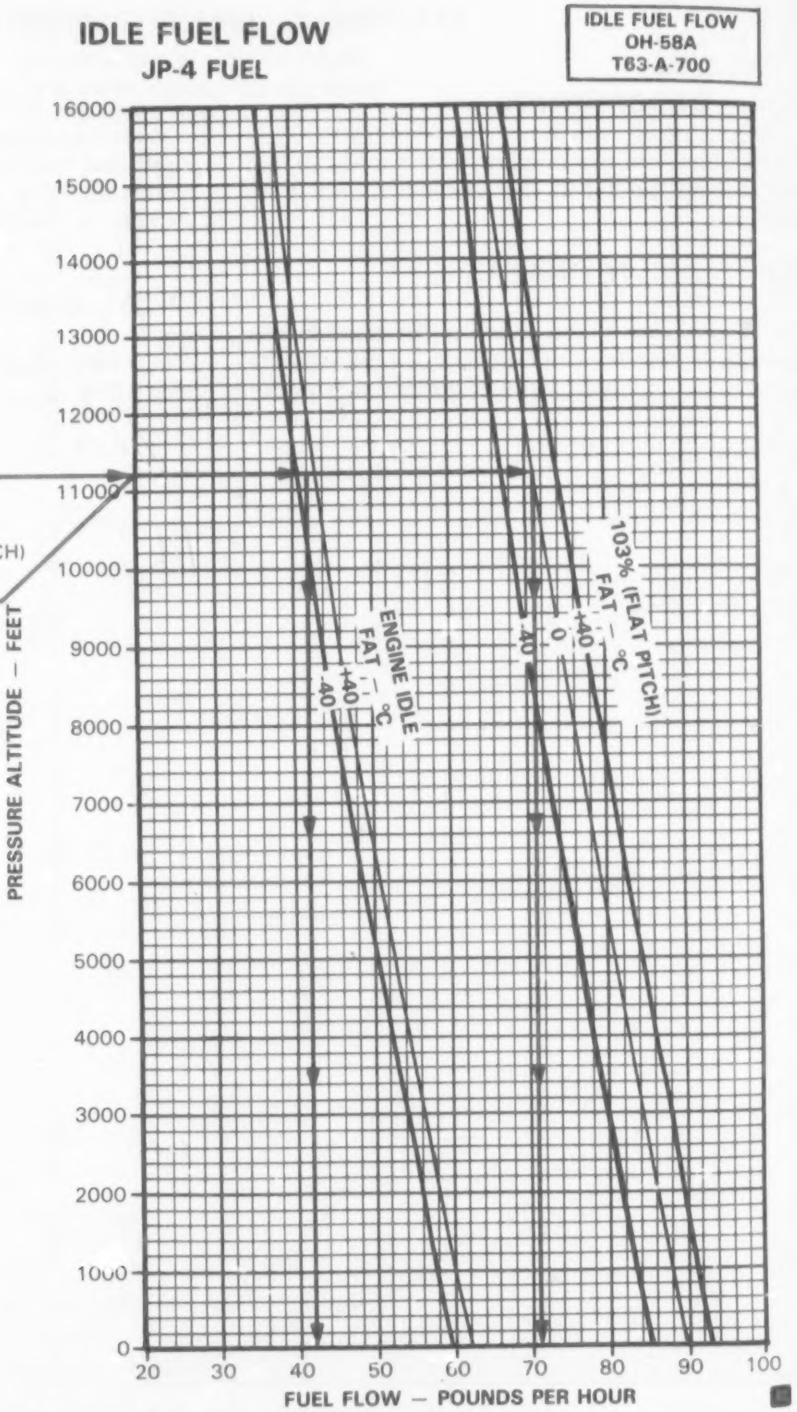
FUEL FLOW AT 103% (FLAT PITCH)
AND ENGINE IDLE

KNOWN

PRESSURE ALTITUDE = 11200 FEET
FAT = 0°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO 103% (FLAT PITCH)
FAT = 0°C
MOVE DOWN, READ 103% (FLAT PITCH)
FUEL FLOW = 71 LB/HR
REENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO ENGINE IDLE
FAT = 0°C
MOVE DOWN, READ ENGINE IDLE
FUEL FLOW = 42 LB/HR



DATA BASIS: CALCULATED FROM MODEL SPEC 803, 19 JULY 1968, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST, USA ASTA 68-30, SEPTEMBER 1970

206900-524

Figure 7-10. Idle Fuel Flow Chart A

SECTION X. TORQUE AVAILABLE C

7-37. DESCRIPTION.

The torque available charts show the effects of altitude and temperature on engine torque.

7-38. CHART DIFFERENCES.

Both pressure altitude and FAT affect engine power production. Figures 7-11 and 7-12 show power available data at 30 minute power and maximum continuous power ratings in terms of the allowable torque as recorded by the torquemeter (%Q).

Note that the power output capability of the T63-A-720 engine can exceed the transmission structural limit (100 %Q) under certain conditions.

a. Figure 7-11 (sheet 1) is applicable for maximum power, engine deice and heater off, 30 minute operation at 100% N2 rpm.

b. Figure 7-11 (sheet 2) is applicable for maximum power, engine deice and heater on, 30 minute operation at 100% N2 rpm.

c. Figure 7-11 (sheet 3) is applicable for maximum power, engine deice and heater off and reverse flow inlet installed, 30 minute operation at 100% N2 rpm.

d. Figure 7-11 (sheet 4) is applicable for maximum power, engine deice and heater on and reserve flow inlet installed, 30 minute operation at 100% N2 rpm.

e. Figure 7-12 (sheets 1 through 4) is applicable for maximum continuous power for the above mentioned conditions.

f. Prolonged IGE hover may increase engine inlet temperature as much as 10°C, therefore, a higher FAT must be used to correct for the increase under this condition.

7-39. USE OF CHARTS.

The primary use of the charts is illustrated by the examples. In general, to determine the maximum power available, it is necessary to know the pressure altitude and temperature. By entering the upper left side of the chart at the known pressure altitude, moving right to the known temperature, then straight down to the bottom of the lower grid, available torque is obtained. If the CONT XMSN LIM line is intersected prior to reaching the temperature line, TORQUE AVAILABLE is 85%. Operations in the yellow area of the chart (between 85 and 100%) are limited to 5 minutes duration.

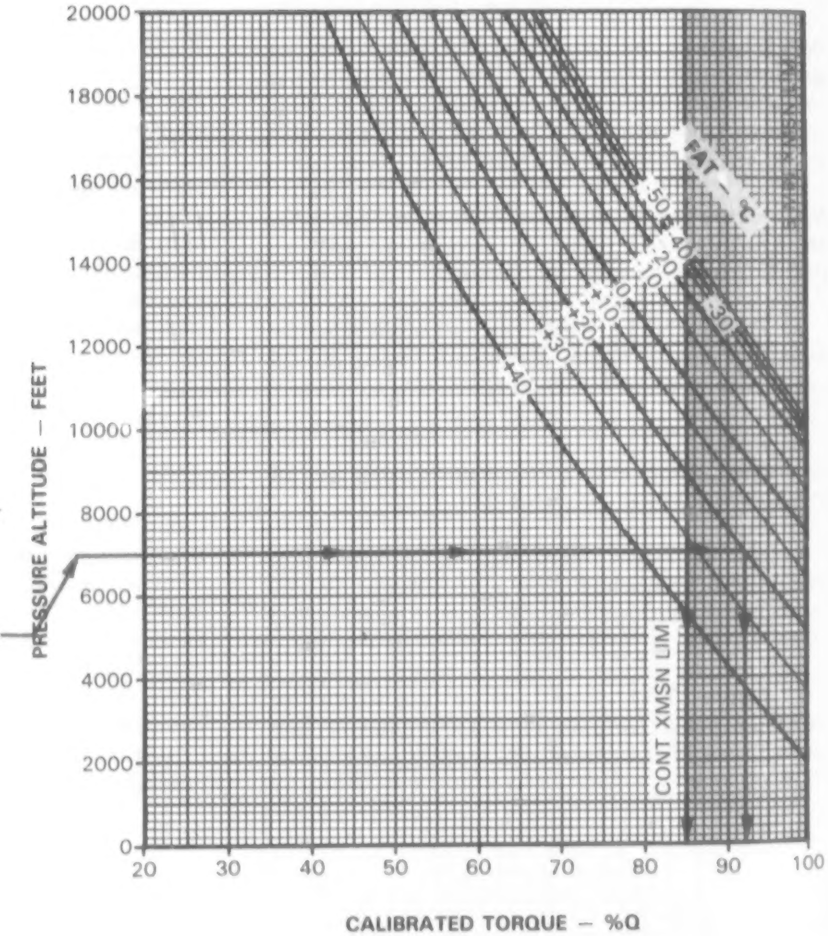
7-40. CONDITIONS.

Chart (figure 7-11) is based upon speeds @ 100% rotor/engine rpm with grade JP-4 fuel. The use of aviation gasoline will not influence engine power. Fuel grade of JP-5 will yield the same nautical miles per pound of fuel and being 6.8 pounds per gallon will only result in increased fuel weight per gallon. Because JP-4 and JP-5 have the same energy value per pound, then JP-5 fuel will increase range by almost 5 percent per gallon of fuel. The 30 minutes operation limit is based on TOT indication.

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)

ENGINE DEICE AND HEATER OFF
100% RPM, JP-4 FUEL

MAXIMUM
TORQUE
OH-58C
T63-A-720



EXAMPLE

WANTED

CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = 20°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO READ
CALIBRATED = 92.5%Q (5 MIN)
CALIBRATED = 85%Q (30 MIN)

DATA BASIS: CALCULATED FROM MODEL SPEC 876, 25 JULY 1975, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

206900-525-1

Figure 7-11. Maximum Torque Available (30 Minute Operation) Chart **C** (Sheet 1 of 4)

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)

ENGINE DEICE AND HEATER ON
100% RPM, JP-4 FUEL

MAXIMUM
TORQUE
OH-58C
T63-A-720

EXAMPLE

WANTED

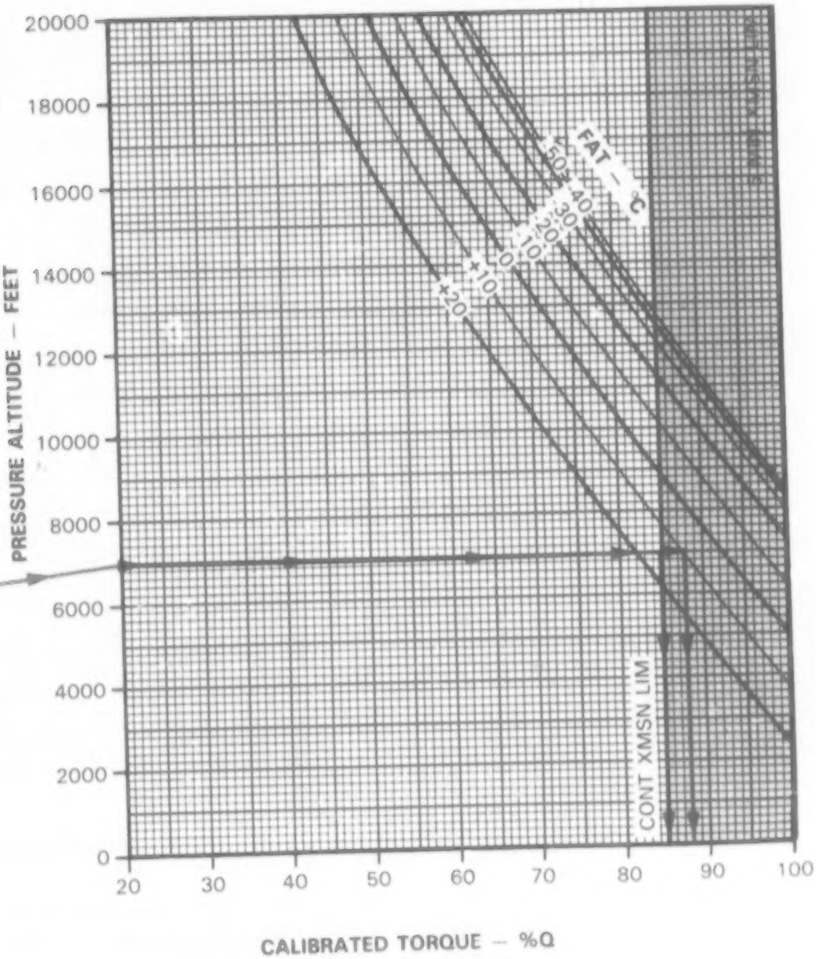
CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = 10°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN, READ
CALIBRATED TORQUE = 87.7%Q
(5 MIN)
CALIBRATED TORQUE = 85.5%Q
(30 MIN)



DATA BASIS: CALCULATED FROM MODEL SPEC 876, 25 JULY 1975, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

206900-525-2

Figure 7-11. Maximum Torque Available (30 Minute Operation) Chart C (Sheet 2 of 4)

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)

ENGINE DEICE AND HEATER OFF AND REVERSE FLOW INLET INSTALLED
100% RPM, JP-4 FUEL

MAXIMUM
TORQUE
OH-58C
T63-A-720

EXAMPLE

WANTED

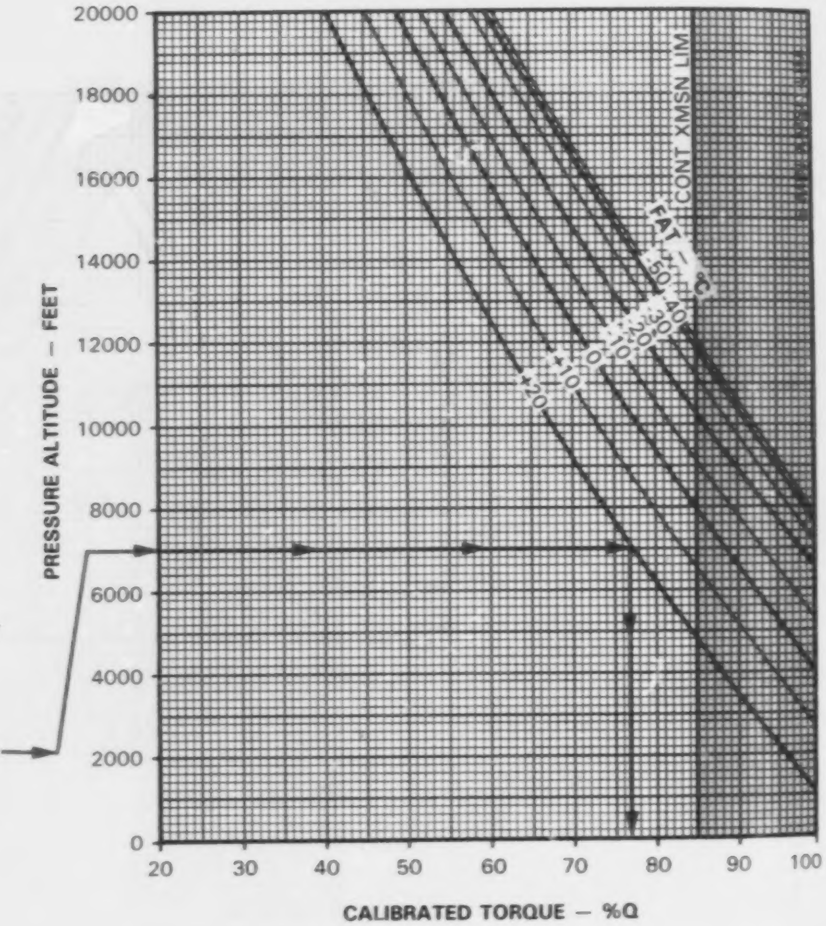
CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = 20°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN, READ
CALIBRATED TORQUE = 76.8%Q



DATA BASIS: CALCULATED FROM MODEL SPEC 876, 25 JULY 1975,
CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

206900-525-3

Figure 7-11. Maximum Torque Available (30 Minute Operation) Chart **C** (Sheet 3 of 4)

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☐
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MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)

ENGINE DEICE AND HEATER ON AND REVERSE FLOW INLET INSTALLED
100% RPM, JP-4 FUEL

MAXIMUM
TORQUE
OH-58C
T63-A-720

EXAMPLE

WANTED

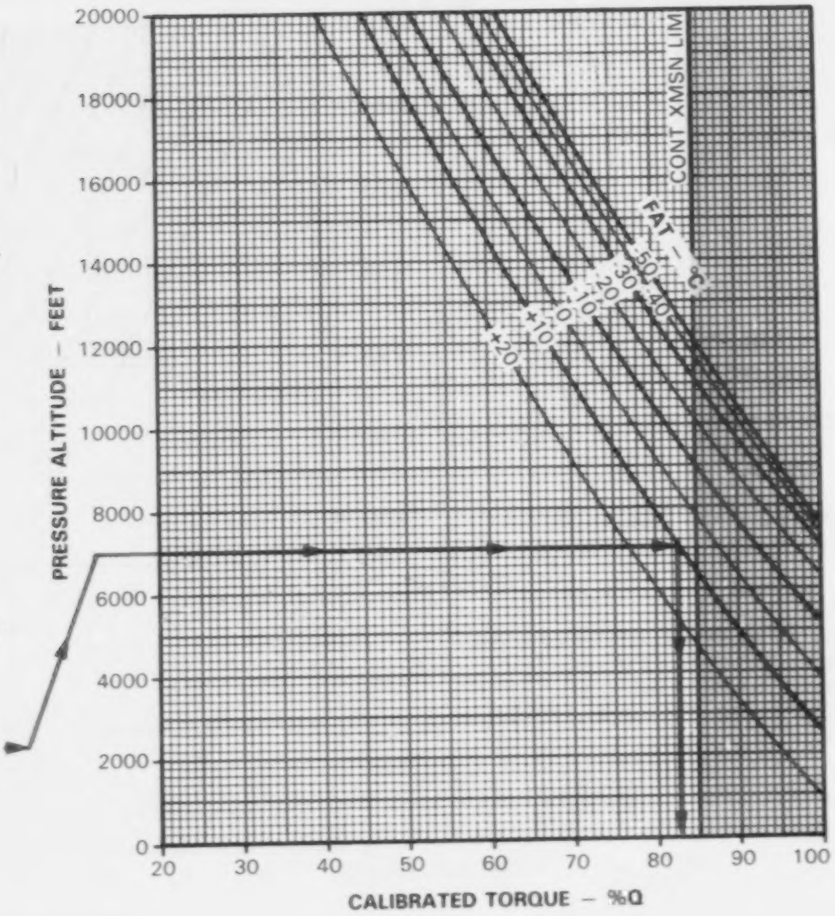
CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = 10°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN, READ
CALIBRATED = 83.5%Q



DATA BASIS: CALCULATED FROM MODEL SPEC 876, 25 JULY 1975, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

206900-525-4

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Figure 7-11. Maximum Torque Available (30 Minute Operation) Chart C (Sheet 4 of 4)

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TORQUE
AVAILABLE
OH-58C
T63-A-720

TORQUE AVAILABLE — CONTINUOUS OPERATION

ENGINE DEICE AND HEATER OFF
100% RPM, JP-4 FUEL

EXAMPLE

WANTED

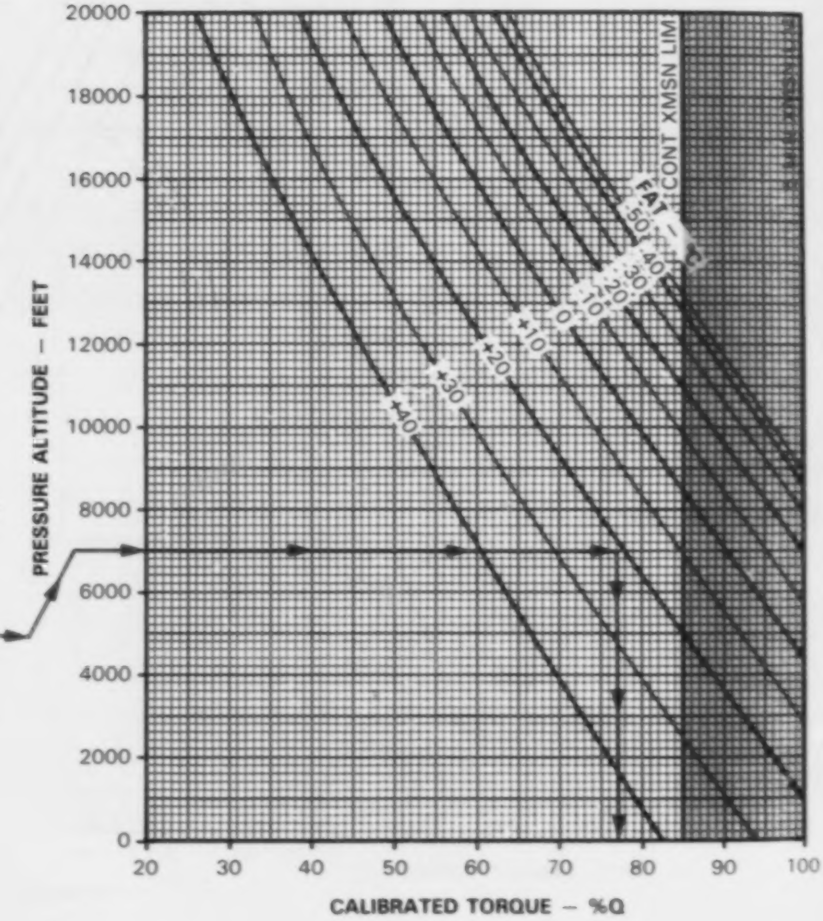
CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = 20°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN, READ
CALIBRATED TORQUE = 76.5%Q



DATA BASIS: CALCULATED FROM MODEL SPEC 876, 25 JULY 1975, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

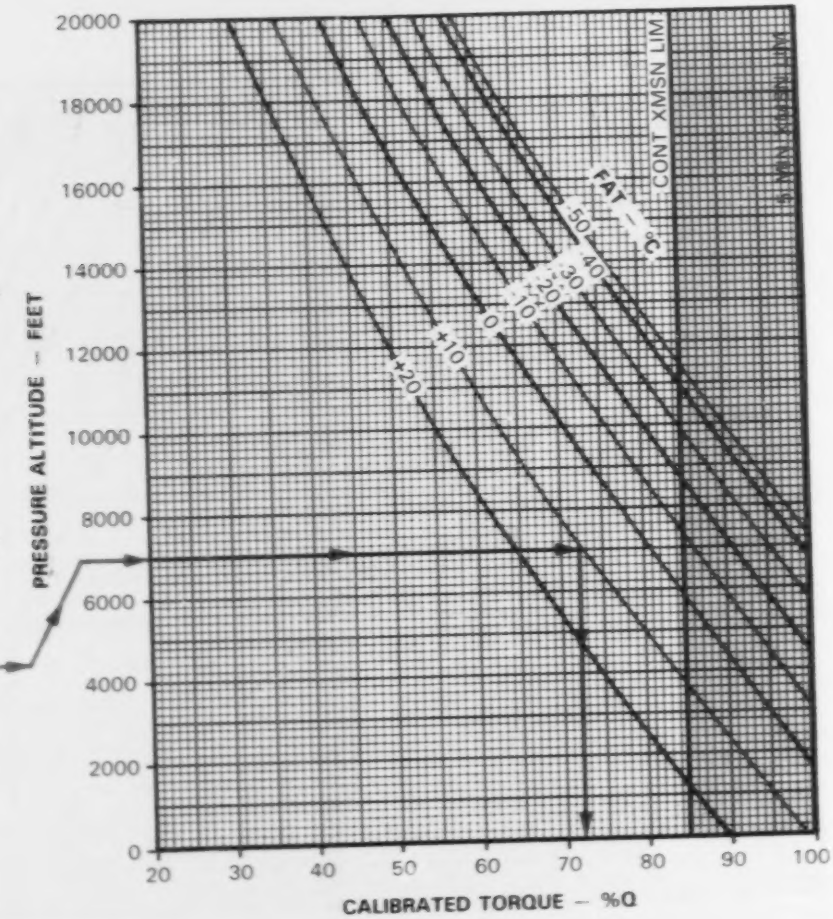
206900-526-1

Figure 7-12. Torque Available (Continuous Operation) Chart C (Sheet 1 of 4)

TORQUE AVAILABLE—CONTINUOUS OPERATION

ENGINE DEICE AND HEATER ON
100% RPM, JP-4 FUEL

TORQUE AVAILABLE
OH-58C
T63-A-720



EXAMPLE

WANTED

CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = 10°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN, READ
CALIBRATED TORQUE = 72.5%Q

DATA BASIS: CALCULATED FROM MODEL SPEC 876, 25 JULY 1975. CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST OF SIMILAR AIRCRAFT

206900-526-2

Figure 7-12. Torque Available (Continuous Operation) Chart **C** (Sheet 2 of 4)

TORQUE AVAILABLE—CONTINUOUS OPERATION
ENGINE DEICE AND HEATER OFF AND REVERSE FLOW INLET INSTALLED
100% RPM, JP-4 FUEL

TORQUE
AVAILABLE
OH-58C
T63-A-720

EXAMPLE

WANTED

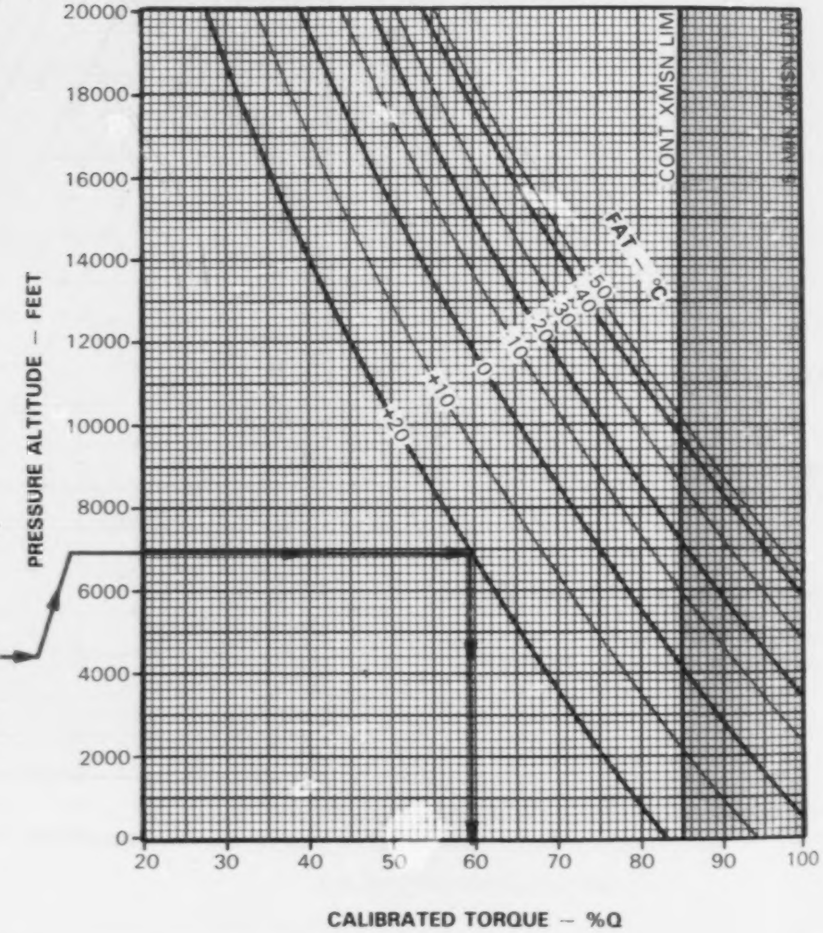
CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = 20°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN, READ
CALIBRATED TORQUE = 59.5%Q



DATA BASIS: CALCULATED FROM MODEL SPEC 876, 25 JULY 1975, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

206900-526-3

Figure 7-12. Torque Available (Continuous Operation) Chart C (Sheet 3 of 4)

TORQUE AVAILABLE — CONTINUOUS OPERATION

BLEED AIR ON PARTICLE SEPARATOR AND REVERSE FLOW INLET INSTALLED

100% RPM JP-4

TORQUE
AVAILABLE
OH-58C
T63-A-720

EXAMPLE

WANTED

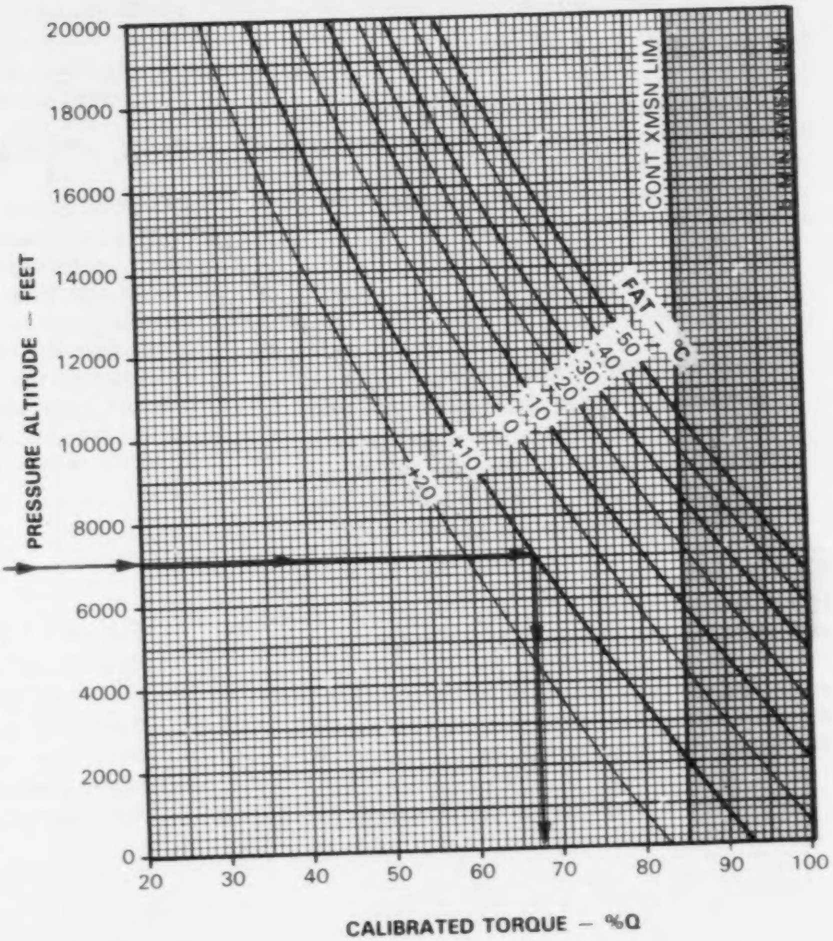
CALIBRATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET
FAT = 10°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN, READ
CALIBRATED TORQUE = 67.5%Q



DATA BASIS: CALCULATED FROM MODEL SPEC 876, 25 JULY 1975. CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

206900-526-4

Figure 7-12. Torque Available (Continuous Operation) Chart C (Sheet 4 of 4)

SECTION XI. HOVER C

7-41. DESCRIPTION.

The hover charts (figure 7-13, sheets 1 and 2) show the hover ceiling and the torque required to hover respectively at various pressure altitudes, ambient temperatures, gross weights, and skid heights. Maximum skid height for hover can also be obtained by using the torque available from figure 7-11.

7-42. USE OF CHART.

a. The primary use of the charts is illustrated by the charts examples. In general, to determine to hover ceiling or the torque required to hover, it is necessary to know the pressure altitude, temperature, gross weight and the desired skid height.

CAUTION

Low airspeed maneuvering flights at airspeeds below 35 knots are not recommended under conditions where the power required to hover out of ground effect exceeds the maximum continuous power.

b. In addition to its primary use, the hover chart (sheet 2) can also be used to determine the predicted maximum hover height, which is needed for use of the takeoff chart (figure 7-14); and the maximum right crosswind corresponding to a 10% directional control margin. To determine maximum right crosswind and hover height proceed as follows:

(1) Enter chart at appropriate pressure altitude.

(2) Move right to FAT.

(3) Move down to gross weight, read the maximum right crosswind corresponding to a 10% directional control margin.

(4) Move left to intersection with maximum power available (obtained from figure 7-11).

(5) Read the predicted maximum skid height. This height is the maximum hover height.

7-43. CONDITIONS.

The hover charts are based upon calm wind conditions, a level ground surface, and the use of 100% N2 rpm. Controllability during downwind hovering, crosswinds, sideward flight and rearward flight may be inadequate; however, for stabilized hover in steady winds from the right (i.e., right crosswind) the wind velocities on the chart correspond to the maximum one can have and yet maintain a 10% directional control margin. See Chapter 5 for hovering and low altitude/low airspeed flight limitations.

WARNING

Figure 7-13 (sheet 3 of 3)shows 10% directional control margins only for the stabilized conditions set forth. It does not and is not meant to infer that for corresponding dynamic flight maneuvering conditions such margins exist.

HOVER CEILING
MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)
100% RPM

HOVER
OH-58C
T63-A-720

EXAMPLE

WANTED

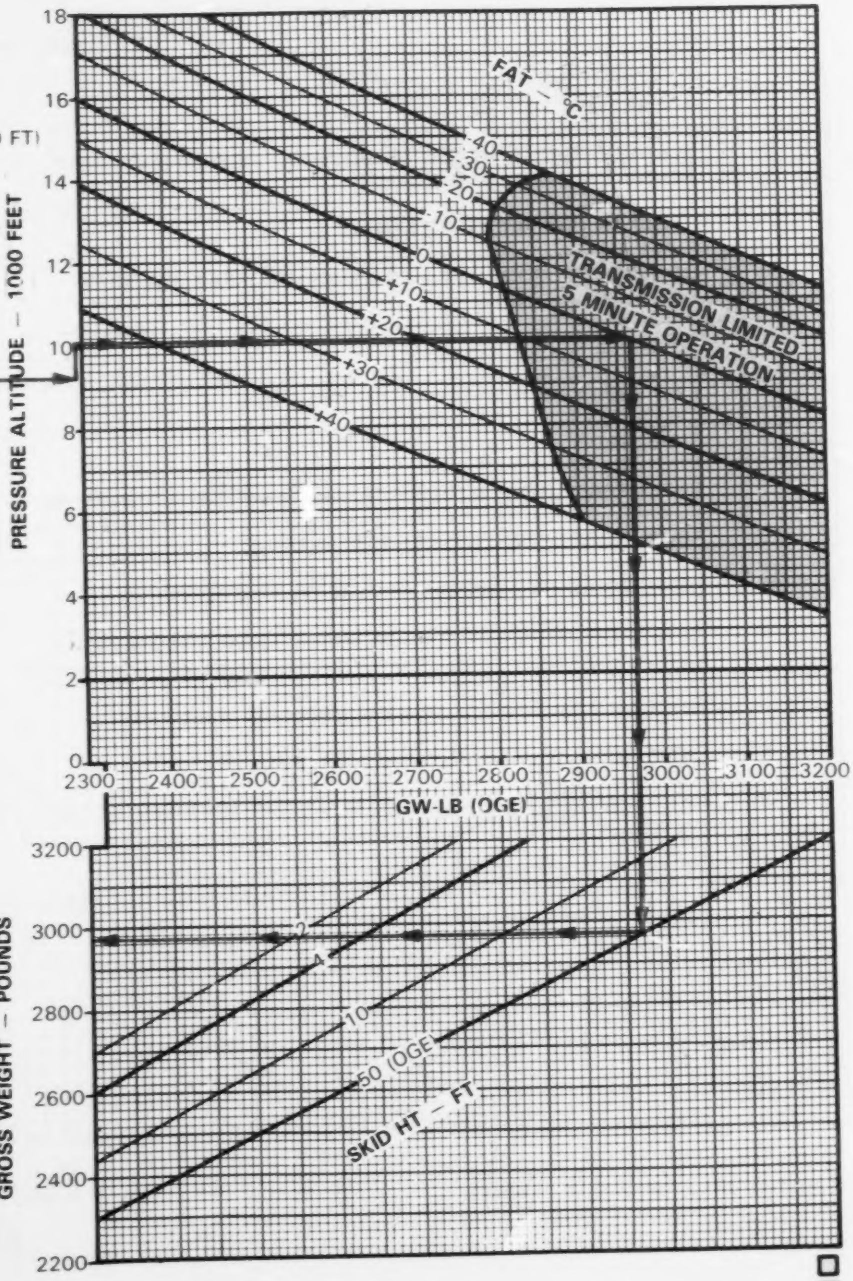
GROSS WEIGHT TO HOVER OGE (50 FT)

KNOWN

PRESSURE ALTITUDE = 10000 FEET
FAT = 0°C
SKID HEIGHT = OGE (50 FT)

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO SKID HEIGHT
MOVE LEFT, READ GROSS WEIGHT
TO HOVER = 2965 POUNDS



DATA BASIS: DERIVED FROM FLIGHT TEST, USA AEFA 74-48, APRIL 1975

206900-527-1

Figure 7-13. Hover Chart C (Sheet 1 of 3)

EXAMPLE

WANTED

MAXIMUM GROSS WEIGHT TO HOVER AT OGE (50 FEET) WITH REVERSE FLOW INLET INSTALLED

KNOWN (SEE FIGURE 7-11 SHEET 3)

30 MINUTE TORQUE AVAILABLE WITH REVERSE FLOW INLET INSTALLED = 76.8%Q

PRESSURE ALTITUDE = 7000 FEET

FAT = +20°C

METHOD

ENTER PRESSURE ALTITUDE HERE ——→——→——→ ①

MOVE RIGHT TO INTERSECT +20°C FAT LINE

MOVE DOWN TO DENSITY ALTITUDE OF 8700 FEET

ENTER TORQUE HERE FOR ENGINE WITH REVERSE FLOW INLET CONDITION ——→——→——→——→ ②

MOVE UP TO INTERSECT OGE (50 FEET) SKID HEIGHT LINE

MOVE RIGHT TO INTERSECT THE VERTICAL

LINE FROM ● AND READ GROSS WEIGHT TO HOVER = 2760 POUNDS

Figure 7-13. Hover Chart **C** (Sheet 2 of 3)

HOVER
OH-58C
T63-A-720

HOVER

AT 100% N2 RPM
ALL CONFIGURATIONS LEVEL SURFACE CALM WIND

EXAMPLE

WANTED

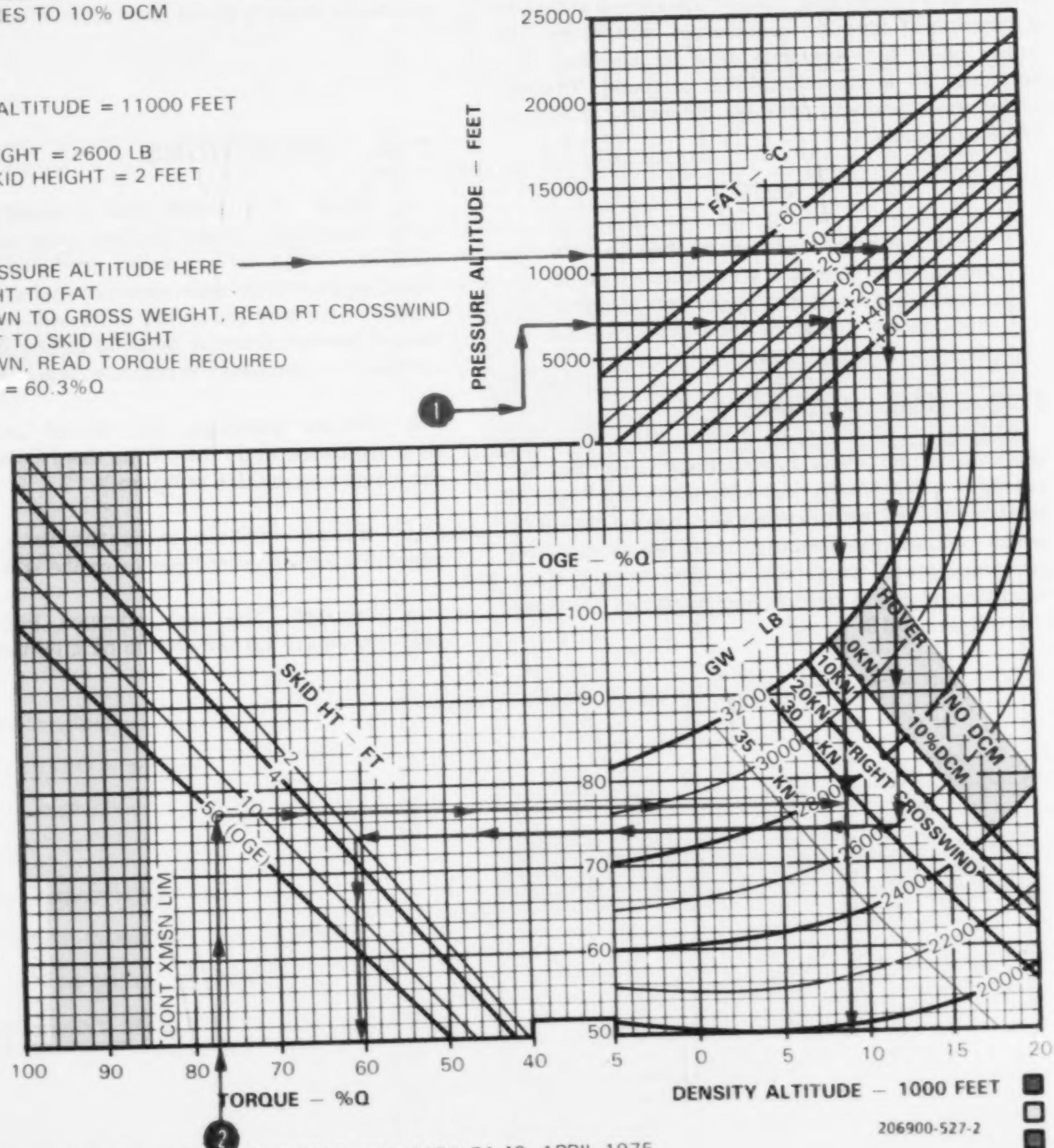
TORQUE REQUIRED TO HOVER & RT CROSSWIND CORRES TO 10% DCM

KNOWN

PRESSURE ALTITUDE = 11000 FEET
FAT = 0°C
GROSS WEIGHT = 2600 LB
DESIRED SKID HEIGHT = 2 FEET

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO GROSS WEIGHT, READ RT CROSSWIND
MOVE LEFT TO SKID HEIGHT
MOVE DOWN, READ TORQUE REQUIRED
TO HOVER = 60.3%Q



DATA BASIS: DERIVED FROM FLIGHT TEST, USA AEFA 74-48, APRIL 1975

Figure 7-13. Hover Chart C (Sheet 3 of 3)

SECTION XII. TAKEOFF C

7-44. DESCRIPTION.

The takeoff chart (figure 7-14) shows the distances to clear various obstacle heights, based upon a level acceleration technique. Takeoff distance is shown as a function of several hover height capabilities. The upper chart grid presents data for climbout at a constant 35 knots INDICATED airspeed. The two lower grids present data for climbouts at various TRUE airspeeds.

NOTE

The hover heights shown on the chart are only a measure of the helicopters climb capability and do not imply that a higher than normal hover height should be used during the actual takeoff.

7-45. USE OF CHART.

The primary use of this chart is illustrated by the chart example. The main consideration for takeoff performance is the hovering skid height capability, which includes the effects of pressure altitude, free air temperature, gross weight, and torque. Hover height capability is determined by use of the hover chart, figure 7-13. A hover check can be made to verify the hover capability. If winds are present, the hover check may disclose that the helicopter can actually hover at a greater skid height than the calculated value, since the hover chart is based upon calm wind conditions.

7-46. CONDITIONS.

a. **Wind.** The takeoff chart is based upon calm wind conditions. Since surface wind velocity and direction cannot be accurately predicted, all takeoff planning should be based upon calm wind conditions. Takeoff into any prevailing wind will improve the takeoff performance. A tailwind during takeoff and climbout will increase the obstacle clearance distance.

b. **Power Settings.** All takeoff performance data are based upon the torque used in determining the hover capabilities in figure 7-13.

c. **Hover.** Yellow indicates limit hovered capability where takeoff performance is marginal.

d. **Takeoff.** The red indicates limited compatibility where takeoff should be attempted.

TAKEOFF

LEVEL ACCELERATION TECHNIQUE FROM A 3 FT SKID HEIGHT
100% RPM, MAXIMUM TORQUE AVAILABLE
ALL CONFIGURATIONS CALM WIND

TAKEOFF
OH-58C
T63-A-720

EXAMPLE A

WANTED

DISTANCE TO CLEAR OBSTACLE

KNOWN

MAXIMUM HOVER HEIGHT = 10 FEET
OBSTACLE HEIGHT = 50 FEET

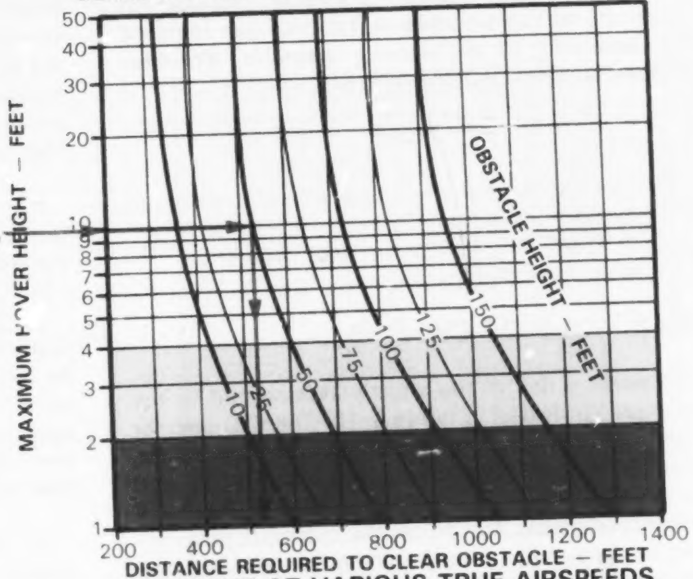
METHOD

ENTER MAX HOVER HEIGHT HERE

MOVE RIGHT TO OBSTACLE HEIGHT

MOVE DOWN, READ DISTANCE
TO CLEAR OBSTACLE = 530 FEET

CLIMBOUT AT 35 KNOTS INDICATED AIRSPEED



CLIMBOUT AT VARIOUS TRUE AIRSPEEDS

EXAMPLE B

WANTED

DISTANCE TO CLEAR OBSTACLE

KNOWN

MAX HOVER HEIGHT = 8 FEET

OBSTACLE HEIGHT = 50 FEET

CLIMBOUT AIRSPEED = 40 KNOTS

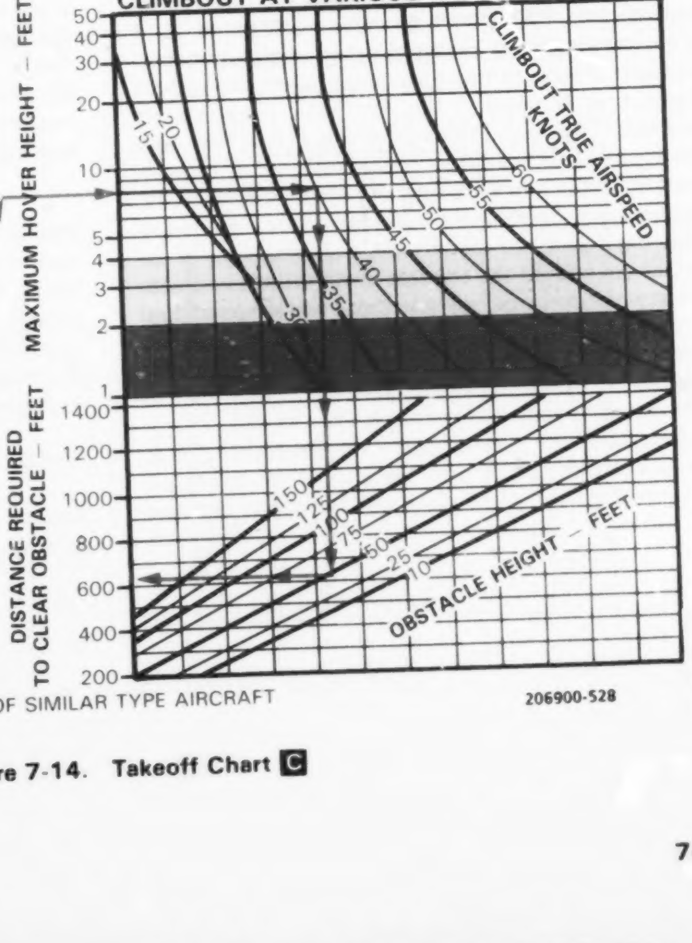
METHOD

ENTER MAX HOVER HEIGHT HERE

MOVE RIGHT TO CLIMBOUT TRUE AIRSPEED

MOVE DOWN TO OBSTACLE HEIGHT

MOVE LEFT, READ DISTANCE
TO CLEAR OBSTACLE = 635 FEET



206900-528

DATA BASIS: DERIVED FROM FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

Figure 7-14. Takeoff Chart C

SECTION XIII. CRUISE C

7-47. DESCRIPTION.

The cruise charts (figure 7-15, sheets 1 through 13) show the torque pressure and engine rpm required for level flight at various pressure altitudes, airspeeds, gross weights, and fuel flows.

NOTE

> The cruise charts are basically arranged by FAT groupings. Figure 7-15, sheets 1 through 13, are based upon operation with clean configuration.

7-48. USE OF CHARTS.

The primary use of the charts is illustrated by the examples provided in figure 7-15. The first step for chart use is to select the proper chart, based upon the planned drag configuration, pressure altitude, and anticipated free air temperature; refer to chapter 7 index (paragraph 7-2). Normally, sufficient accuracy can be obtained by selecting the chart nearest to the planned cruising altitude and FAT, or the next higher altitude and FAT (chart Example A, Method 2). If greater accuracy is required, interpolation between altitudes and/or temperatures will be required (chart Example A, Method 1). You may enter the charts on any side: TAS, IAS, torque pressure, or fuel flow, and then move vertically or horizontally to the gross weight, then to the other three parameters. Maximum performance conditions are determined by entering the chart where the maximum range or maximum endurance and rate of climb lines intersect the appropriate gross weight; then read airspeed, fuel flow, and percent torque. For conservatism, use the gross weight at the beginning of cruise flight. For greater accuracy on long flights it is preferable to determine cruise information for several flight segments in order to allow for decreasing fuel weights (reduced gross weight). The following parameters contained in each chart are further explained as follows:

a. **Airspeed.** True and indicated airspeeds are presented at opposite sides of each chart. On any chart, indicated airspeed can be directly converted to true airspeed (or vice versa) by reading directly across the chart without regard for other chart information. Maximum permissible airspeed (V_{NE}) limits appear as red lines on some charts. If no red line appears, V_{NE} is above the limits of the chart.

b. **Torque (%Q).** Since pressure altitude and temperature are fixed for each chart, torque varies according to gross weight and airspeed.

c. **Fuel Flow.** Fuel flow scales are provided opposite the torque scales. On any chart, torque may be converted directly to fuel flow without regard for other chart information. All fuel flow information is presented with particle separator and engine deice and heater off. Fuel flow increases 5% with reverse flow inlets installed.

d. **Maximum Range.** The maximum range lines indicate the combinations of weight and airspeed that will produce the greatest flight range per gallon of fuel under zero wind conditions. When a maximum range condition does not appear on a chart it is because the maximum range speed is beyond the maximum permissible speed (V_{NE}); in such cases, use V_{NE} cruising speed to obtain maximum range.

e. **Maximum Endurance and Maximum Rate of Climb.** The maximum endurance and maximum rate of climb lines indicate the airspeed for minimum torque required to maintain level flight for each gross weight, FAT, and pressure altitude. Since minimum torque will provide minimum fuel flow, maximum flight endurance will be obtained at the airspeeds indicated.

7-49. CONDITIONS.

The cruise charts are based upon operation at 100% rpm, engine deice and heater off.

CRUISE
PRESSURE ALTITUDE — SEA LEVEL TO 2000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
100% RPM
FAT = – 30°C

CRUISE
OH-58C
T63-A-720

EXAMPLE A

WANTED

TORQUE REQUIRED FOR LEVEL FLIGHT, FUEL FLOW, INDICATED AIRSPEED

KNOWN

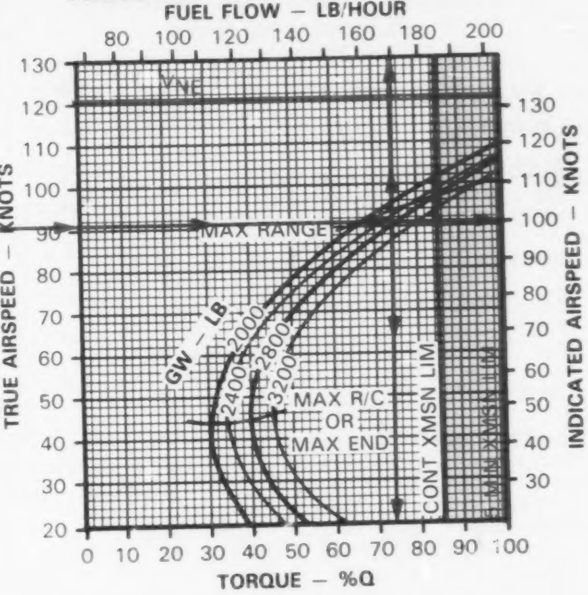
CLEAN CONFIGURATION
GROSS WEIGHT = 2800 LB
PRESSURE ALTITUDE = 1000 FEET
FAT = -30°C
DESIRED TRUE AIRSPEED = 90 KNOTS

METHOD 1 (INTERPOLATE — MOST ACCURATE)

ENTER TRUE AIRSPEED HERE →
READ TORQUE, FUEL FLOW, AND IAS ON EACH ADJACENT ALTITUDE AND/OR FAT, THEN INTERPOLATE BETWEEN ALTITUDE AND FAT

ALTITUDE, FEET	SEA LEVEL	2000 FEET	1000 FEET
FAT, C	-30	-30	-30
TORQUE, %Q	73	70	71.5
FUEL FLOW LB/HR	168	161	164.5
IAS, KNOTS	99	96	97.5

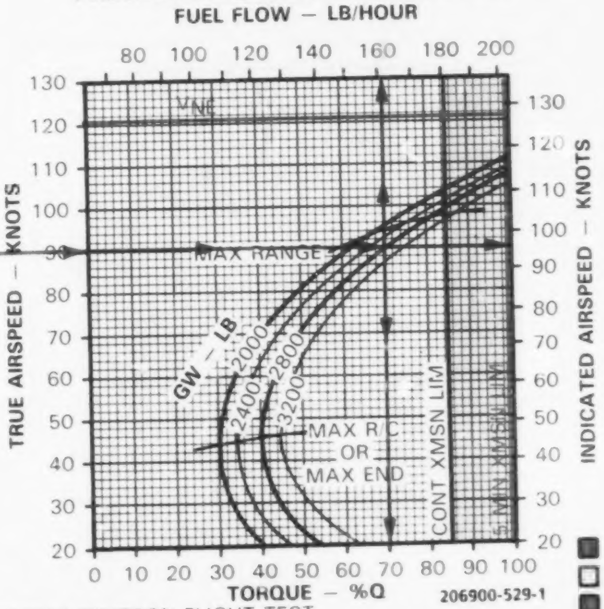
PRESSURE ALTITUDE — SEA LEVEL



PRESSURE ALTITUDE — 2000 FEET

METHOD 2 (SIMPLEST)

USE NEXT HIGHEST ALTITUDE AND/OR TEMPERATURE (2000 FEET, -30°C)
ENTER TRUE AIRSPEED HERE →
MOVE RIGHT TO GROSS WEIGHT
MOVE DOWN AND READ CALIBRATED TORQUE = 70%Q
MOVE UP AND READ FUEL FLOW = 161 LB/HR
MOVE RIGHT, READ IAS = 96 KNOTS



DATA BASIS: DERIVED FROM BELL HELICOPTER TEXTRON FLIGHT TEST

Figure 7-15. Cruise Chart C (Sheet 1 of 13)

CRUISE

PRESSURE ALTITUDE — 4000 FEET TO 6000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
100% RPM

FAT = – 30°C

CRUISE
OH-58C
T63-A-720

EXAMPLE B

WANTED

SPEED FOR MAXIMUM RANGE
TORQUE REQUIRED AND FUEL FLOW AT MAXIMUM RANGE
SPEED FOR MAXIMUM ENDURANCE

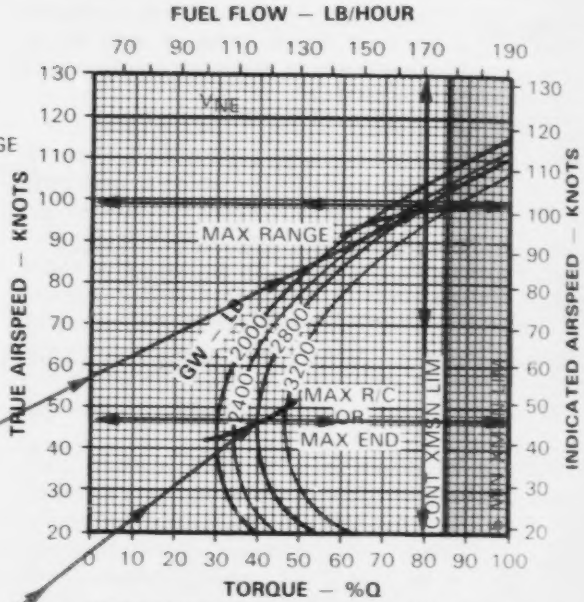
KNOWN

CLEAN CONFIGURATION, FAT = -30°C,
PRESSURE ALTITUDE = 4000 FEET,
AND GROSS WEIGHT = 2800 POUNDS

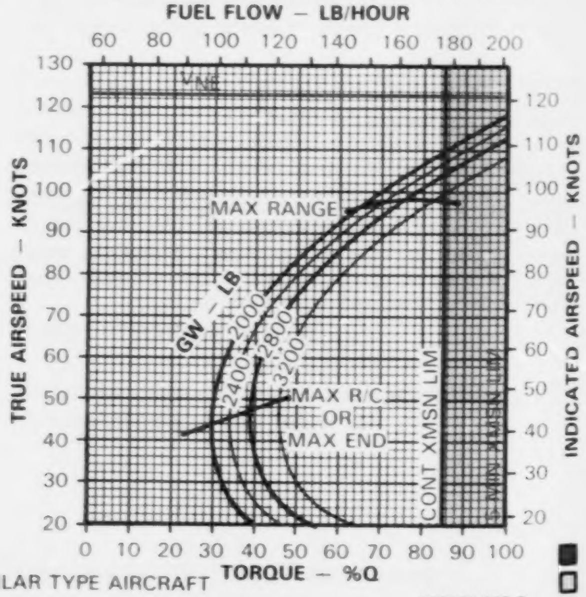
METHOD

LOCATE (-30°C FAT, 4000 FEET) CHART
FIND INTERSECTION OF 2800 LB GROSS WEIGHT LINE
WITH THE MAXIMUM RANGE LINE
TO READ SPEED FOR MAXIMUM RANGE:
  MOVE LEFT, READ TAS = 98.5 KNOTS AND
  MOVE RIGHT, READ IAS = 101 KNOTS
TO READ FUEL FLOW REQUIRED:
  MOVE UP, READ FUEL FLOW = 170 LB/HR
TO READ TORQUE REQUIRED:
  MOVE DOWN, READ TORQUE = 79.5%Q
FIND INTERSECTION OF 2800 LB GROSS WEIGHT LINE
WITH THE MAXIMUM ENDURANCE LINE
TO READ SPEED FOR MAXIMUM ENDURANCE
  MOVE LEFT, READ TAS = 47 KNOTS AND
  MOVE RIGHT, READ IAS = 46 KNOTS

PRESSURE ALTITUDE — 4000 FEET



PRESSURE ALTITUDE — 6000 FEET



DATA BASIS: DERIVED FROM FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

206900-529-2

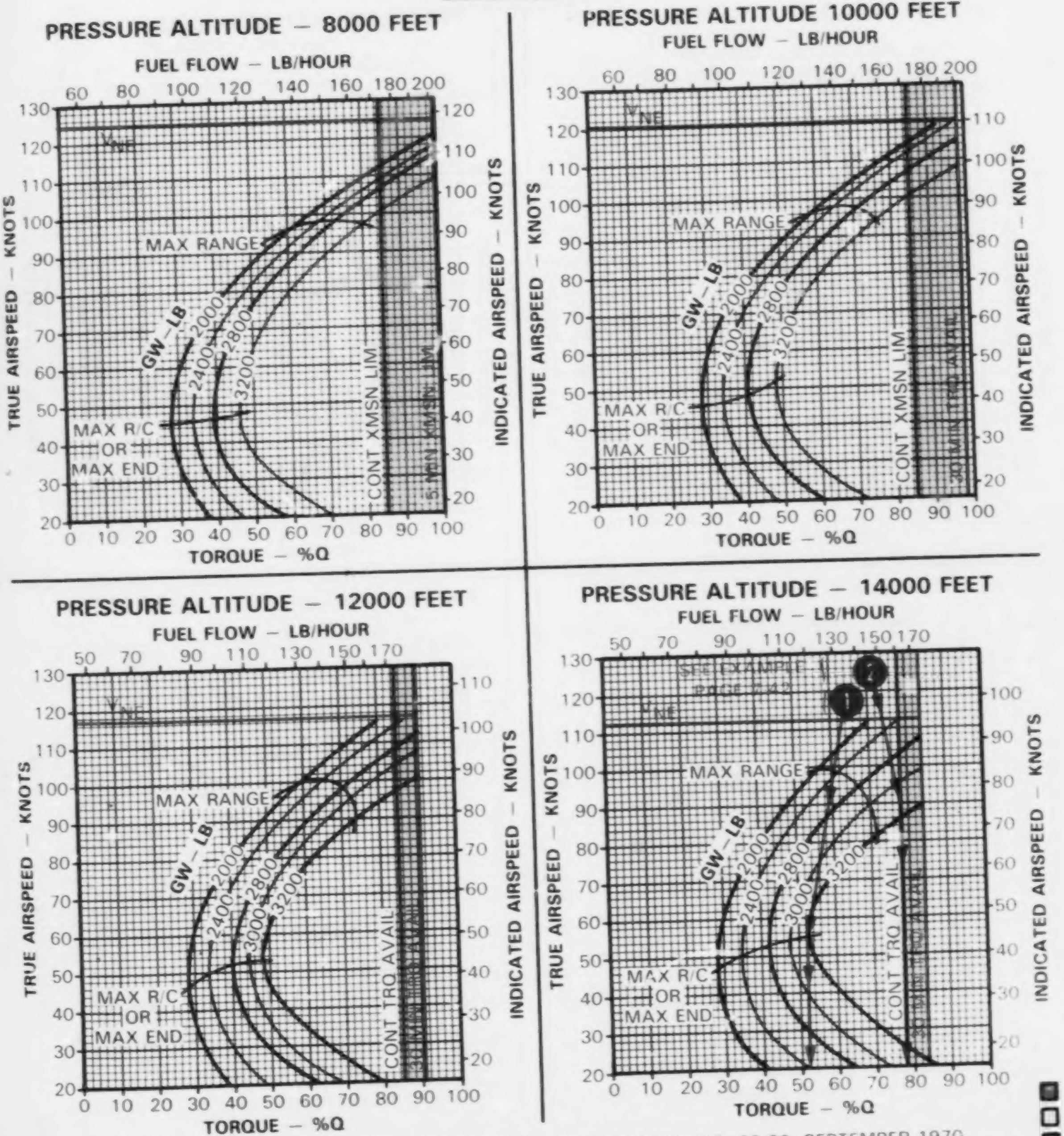
Figure 7-15. Cruise Chart C (Sheet 2 of 13)

CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 14000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
100% RPM

FAT = – 30°C

CRUISE
OH-58C
T63-A-720



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

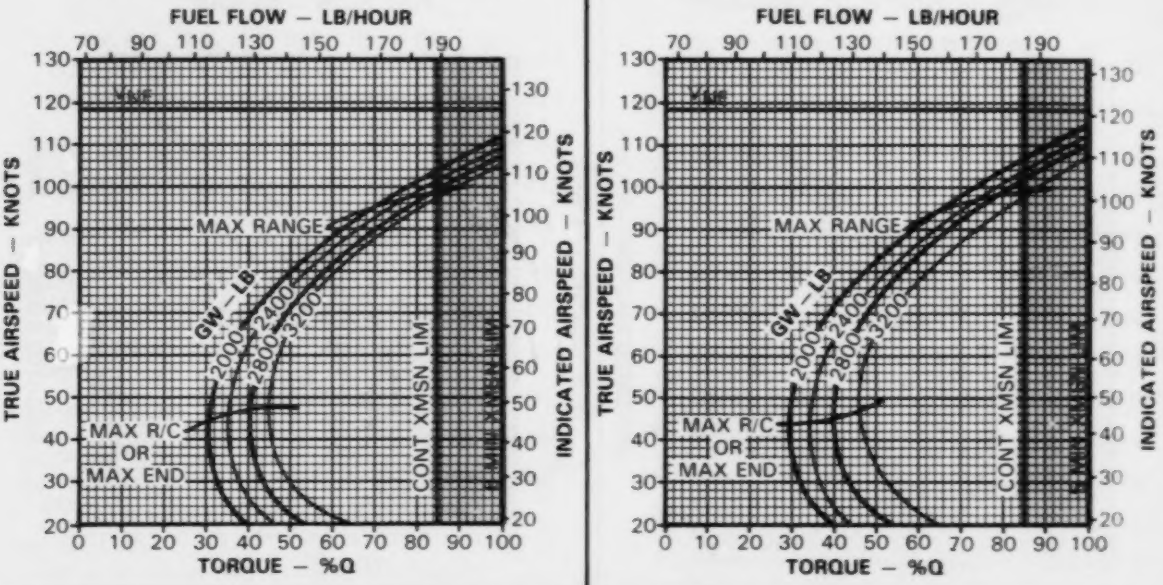
206900-529-3

Figure 7-15. Cruise Chart C (Sheet 3 of 13)

CRUISE

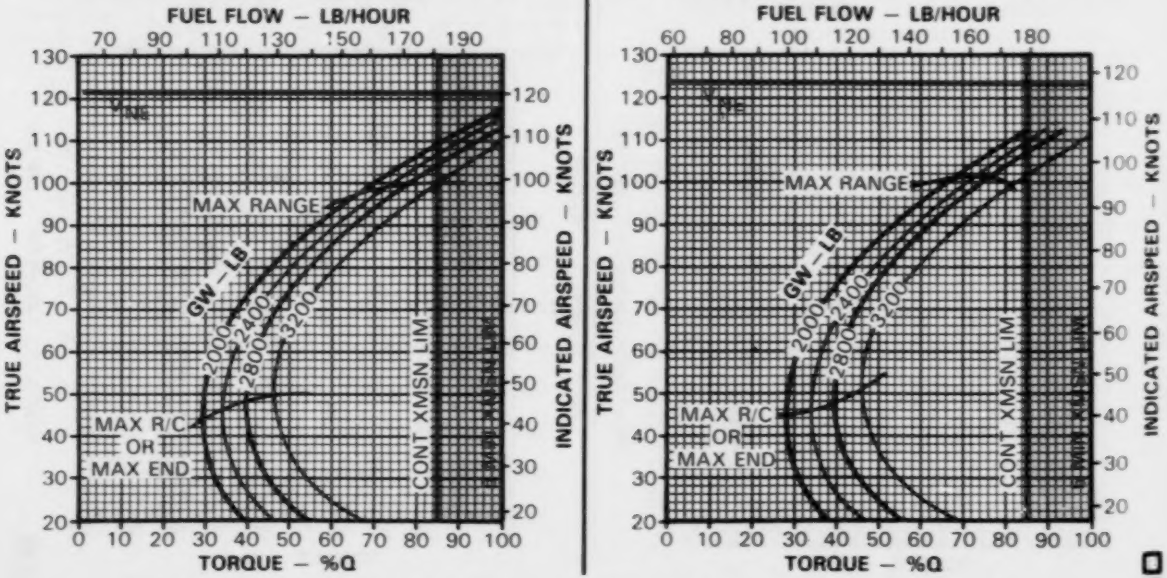
PRESSURE ALTITUDE — SEA LEVEL TO 6000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
100% RPM

FAT = -15°C



PRESSURE ALTITUDE — SEA LEVEL

PRESSURE ALTITUDE 2000 FEET



PRESSURE ALTITUDE — 4000 FEET

PRESSURE ALTITUDE — 6000 FEET

DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-529-4

Figure 7-15. Cruise Chart C (Sheet 4 of 13)

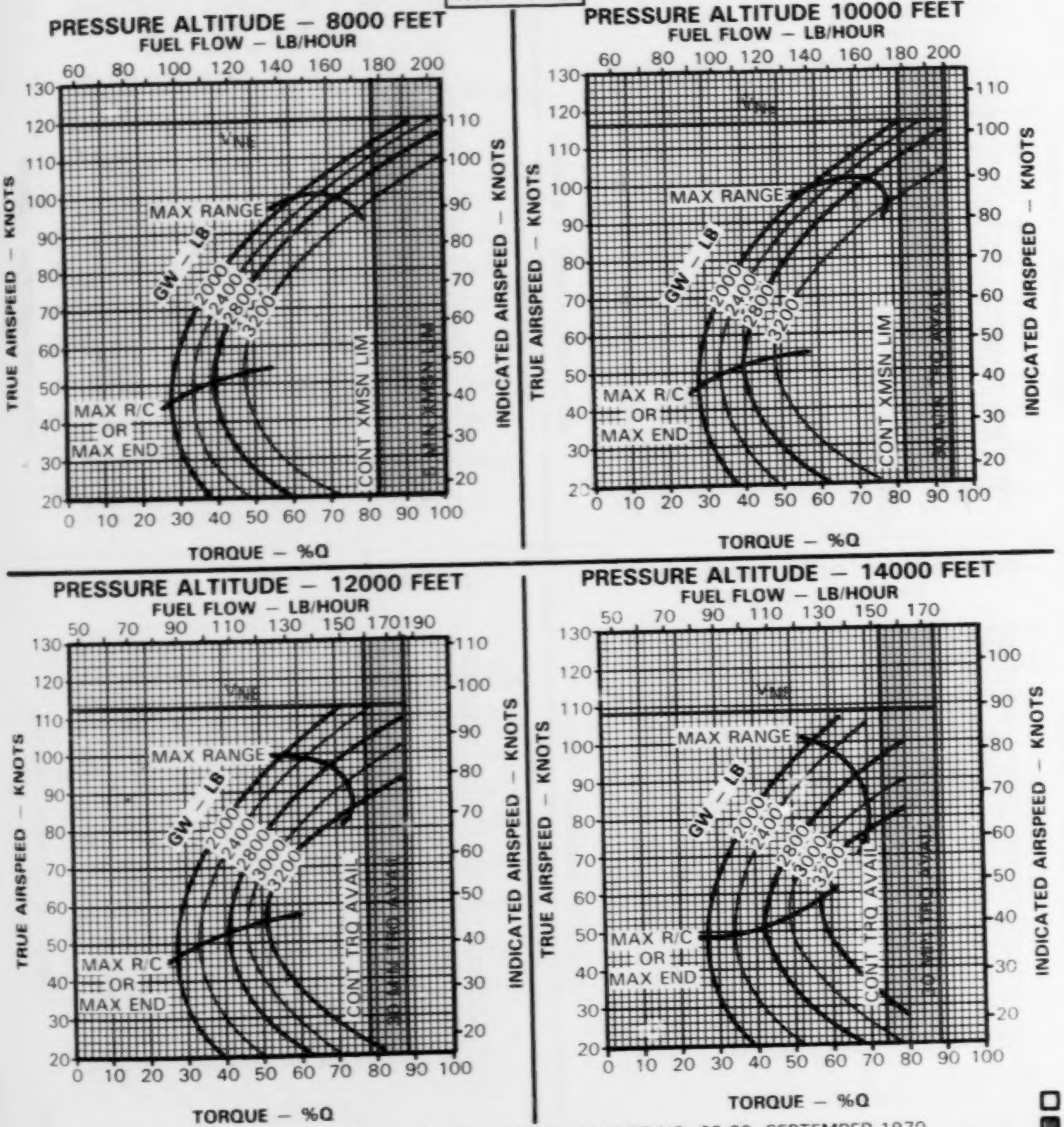
CRUISE
OH-58C
T63-A-720

CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 14000 FEET CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE

100% RPM

FAT = -15°C



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-529-5

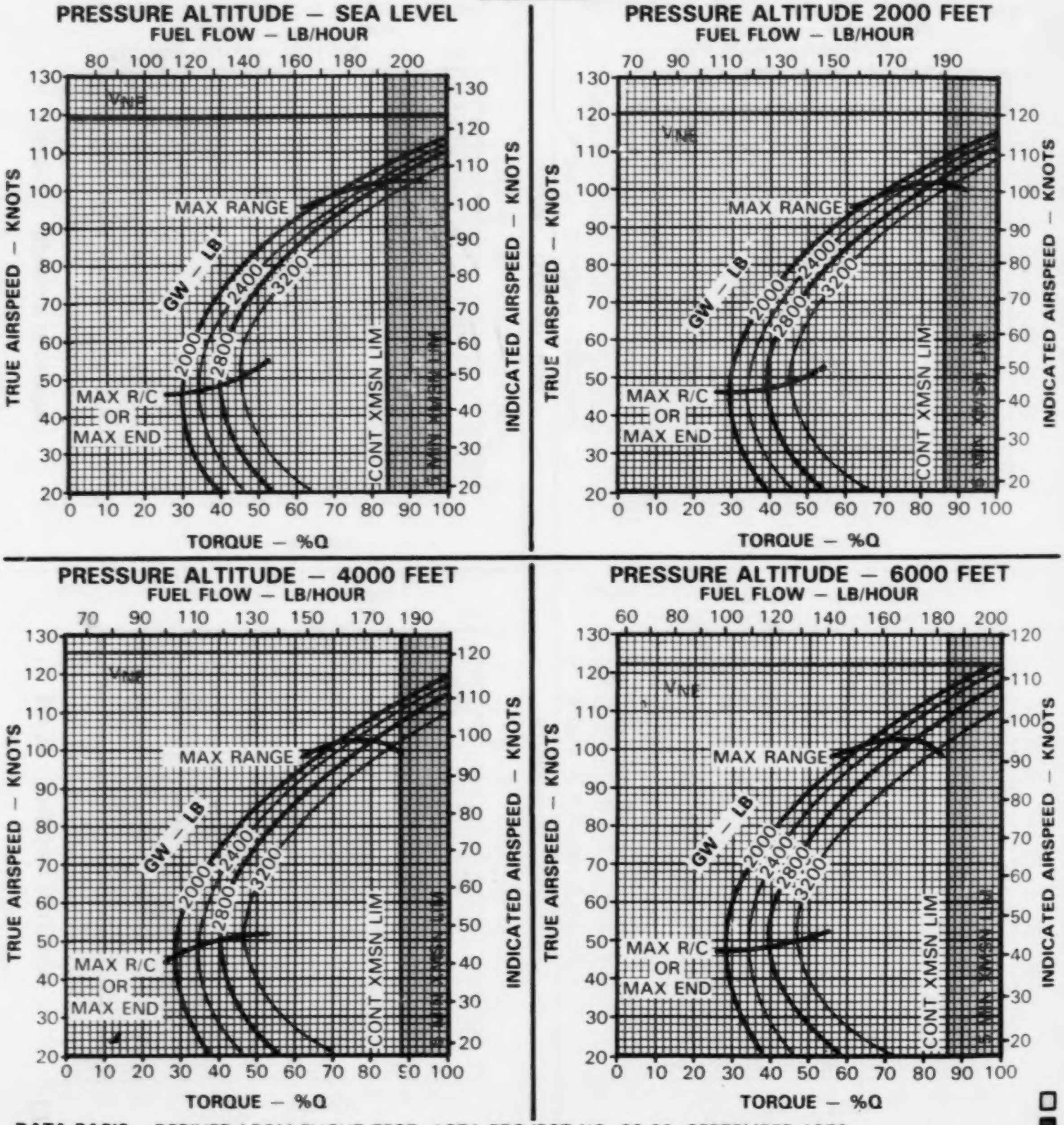
Figure 7-15. Cruise Chart C (Sheet 5 of 13)

CRUISE
OH-58C
T63-A-720

CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 6000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
100% RPM

FAT =0°C



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-529-6

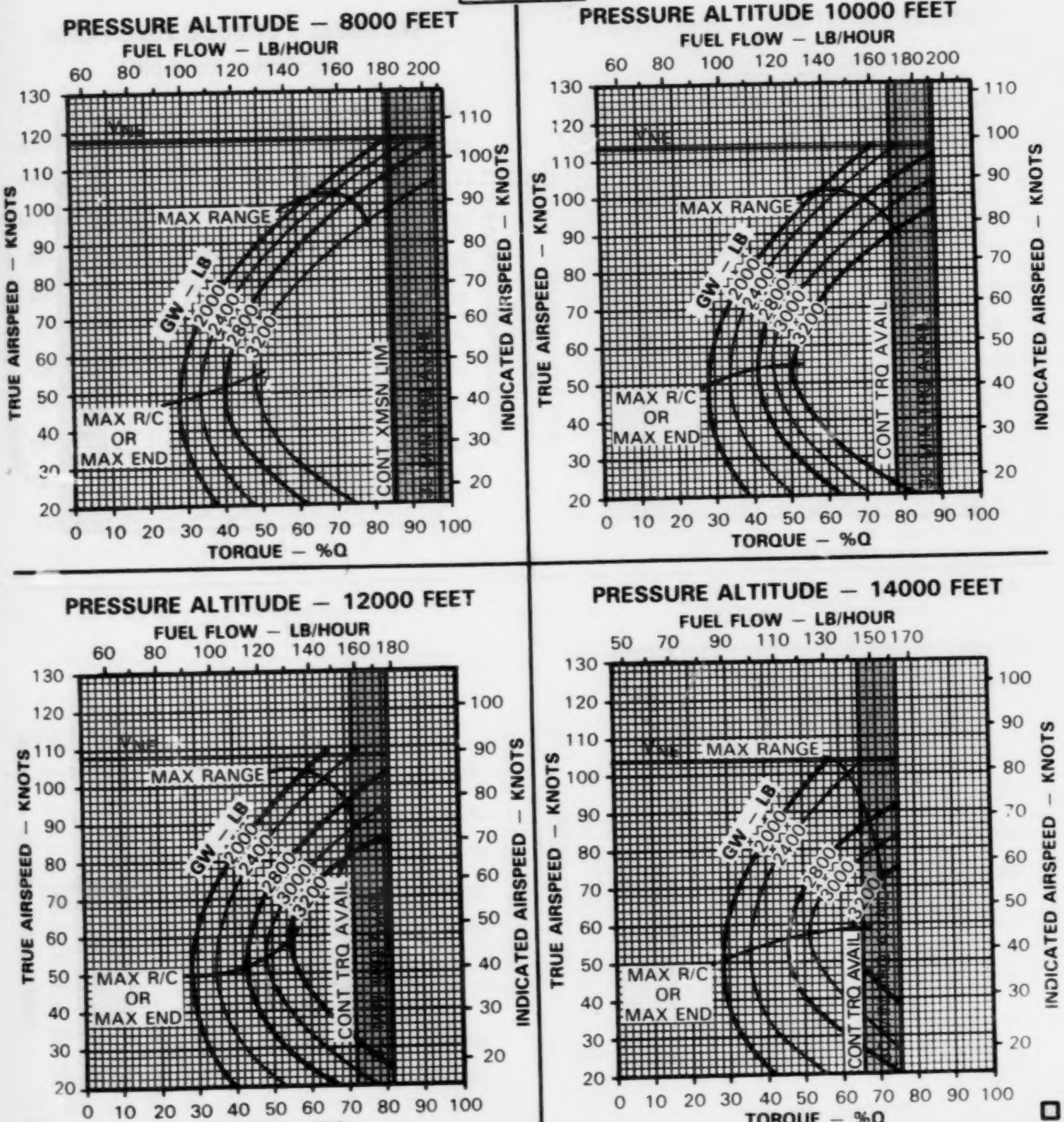
Figure 7-15. Cruise Chart C (Sheet 6 of 13)

CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 14000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
100% RPM

FAT = 0°C

CRUISE
OH-58C
T63-A-720



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

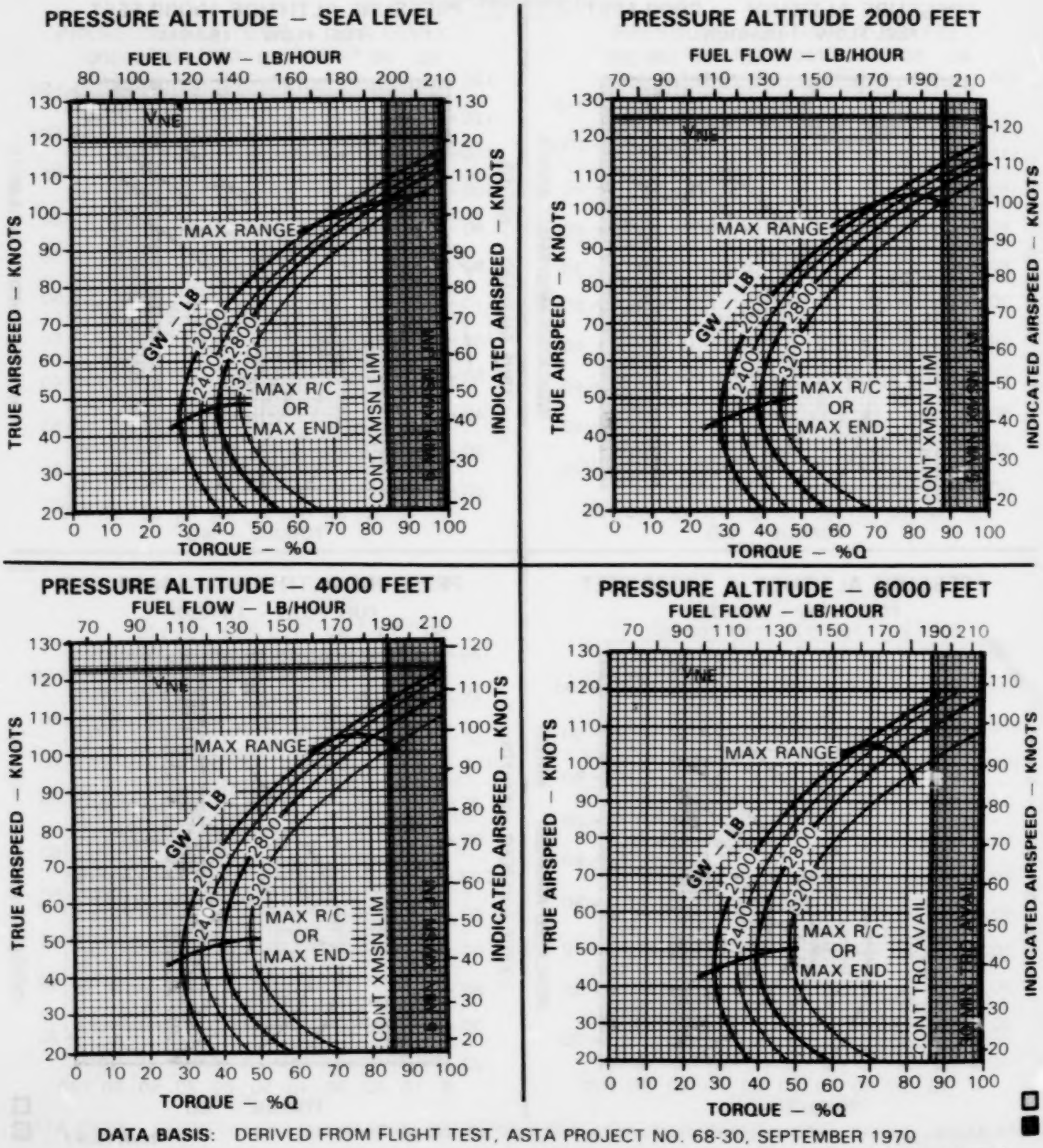
206900-529-7

Figure 7-15. Cruise Chart C (Sheet 7 of 13)

CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 6000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
100% RPM

FAT = + 15°C



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-529-8

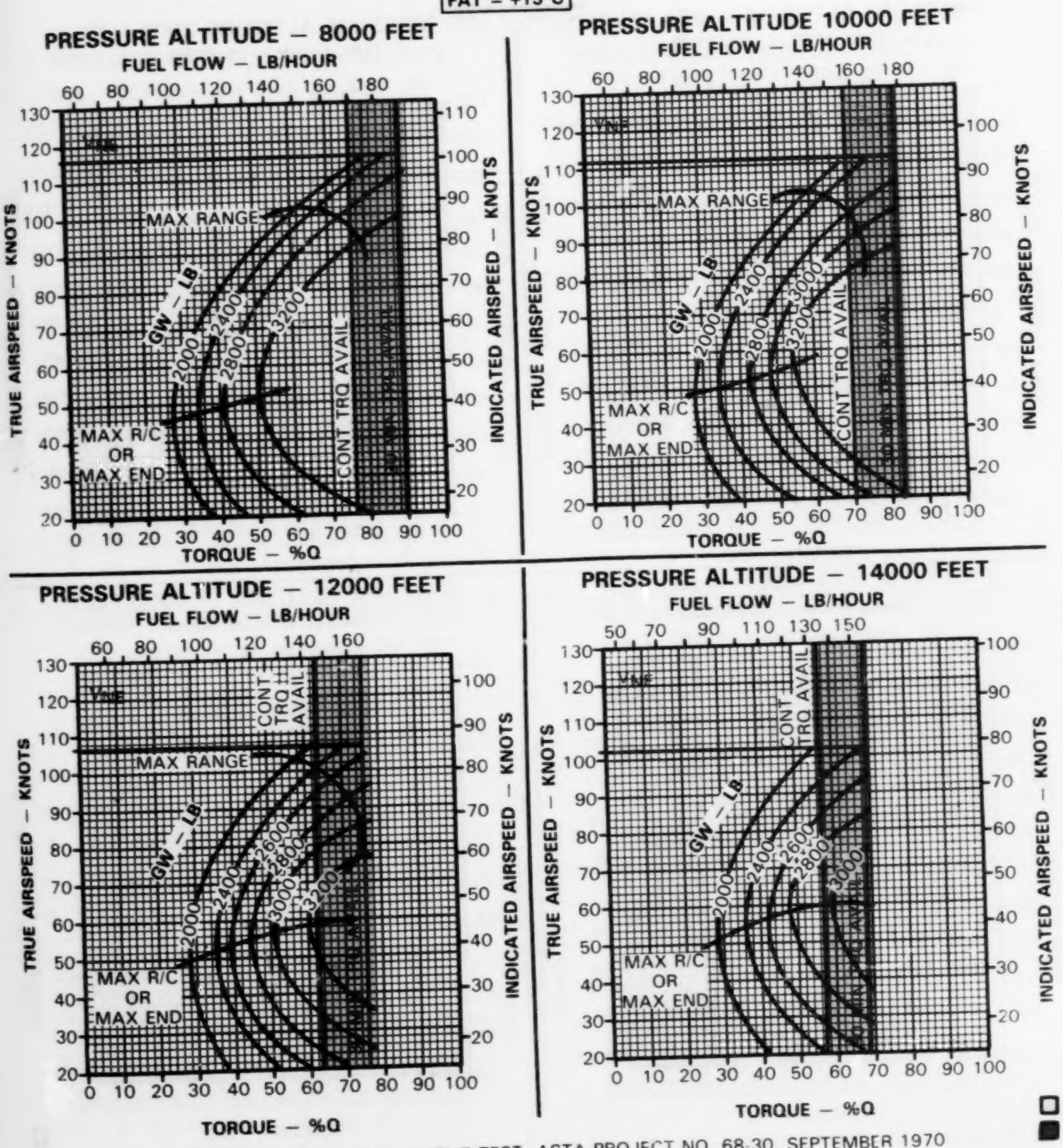
Figure 7-15. Cruise Chart C (Sheet 8 of 13)

CRUISE
PRESSURE ALTITUDE — 8000 FEET TO 14000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE

CRUISE
OH-58C
T63-A-720

100% RPM

FAT = +15°C



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-529-9

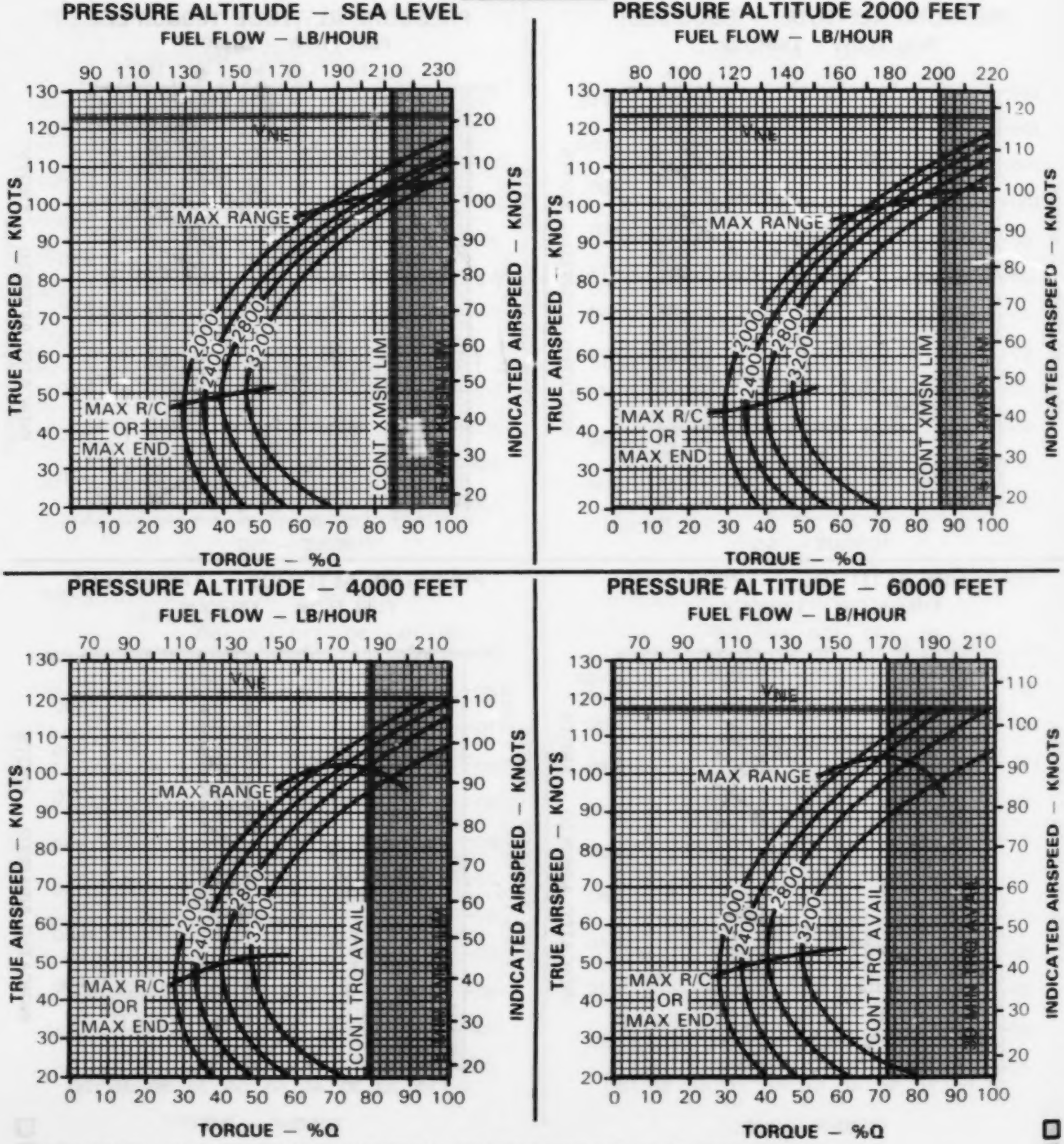
Figure 7-15. Cruise Chart C (Sheet 9 of 13)

CRUISE
OH-58C
T63-A-720

CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 6000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
100% RPM

FAT = +30°C



PRESSURE ALTITUDE — SEA LEVEL

PRESSURE ALTITUDE 2000 FEET

PRESSURE ALTITUDE — 4000 FEET

PRESSURE ALTITUDE — 6000 FEET

DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

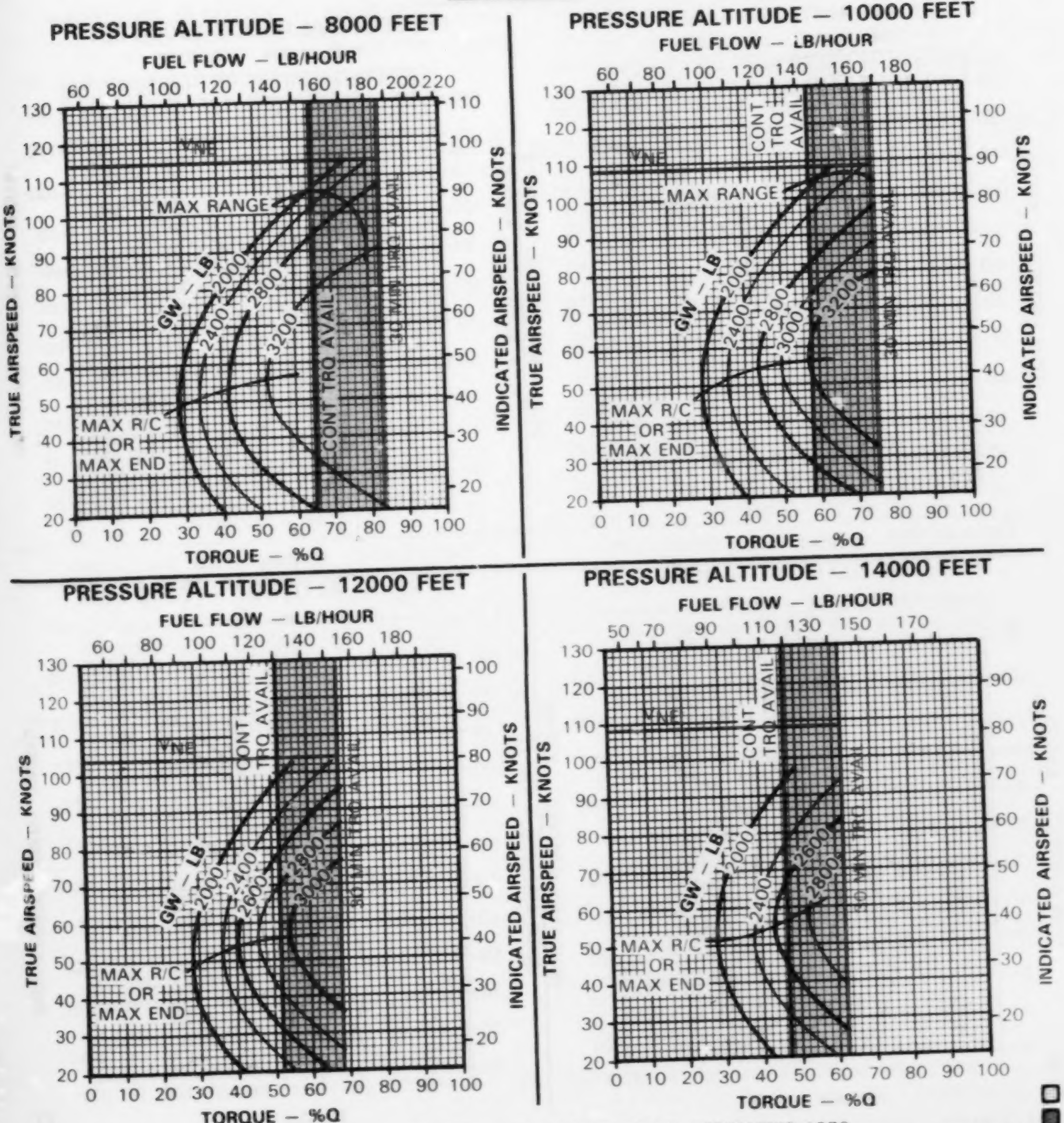
206900-529-10

Figure 7-15. Cruise Chart C (Sheet 10 of 13)

CRUISE
OH-58C
T63-A-720

CRUISE
PRESSURE ALTITUDE — 8000 FEET TO 14000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
100% RPM

FAT = +30°C



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

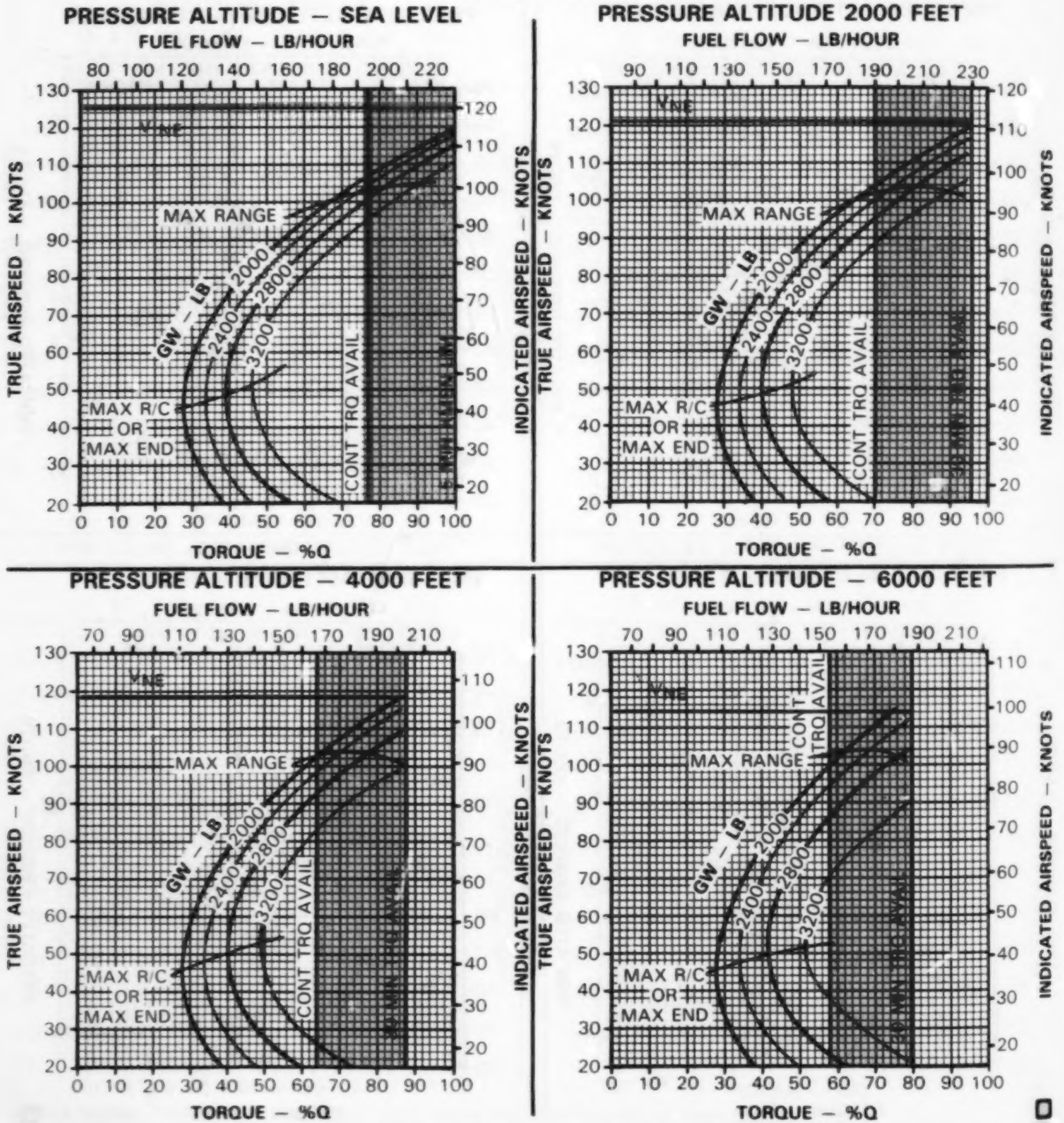
206900-529-11

Figure 7-15. Cruise Chart C (Sheet 11 of 13)

CRUISE
PRESSURE ALTITUDE — SEA LEVEL TO 6000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
100% RPM

CRUISE
OH-58C
T63-A-720

FAT = +45°C



DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68-30, SEPTEMBER 1970

206900-529-12

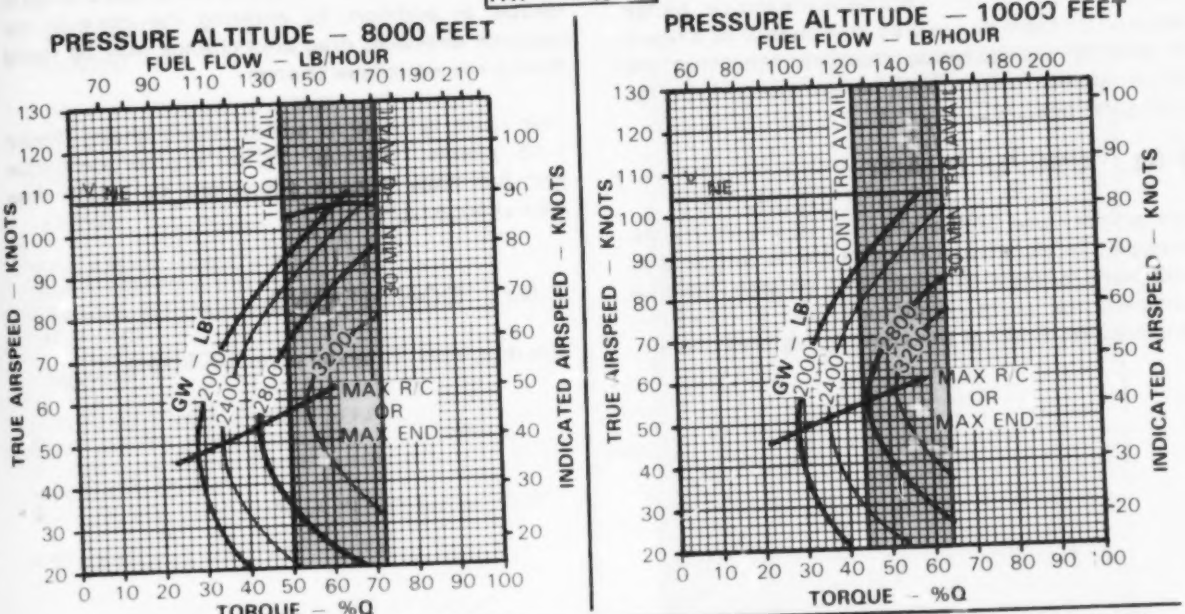
Figure 7-15. Cruise Chart C (Sheet 12 of 13)

CRUISE
OH-58C
T63-A-720

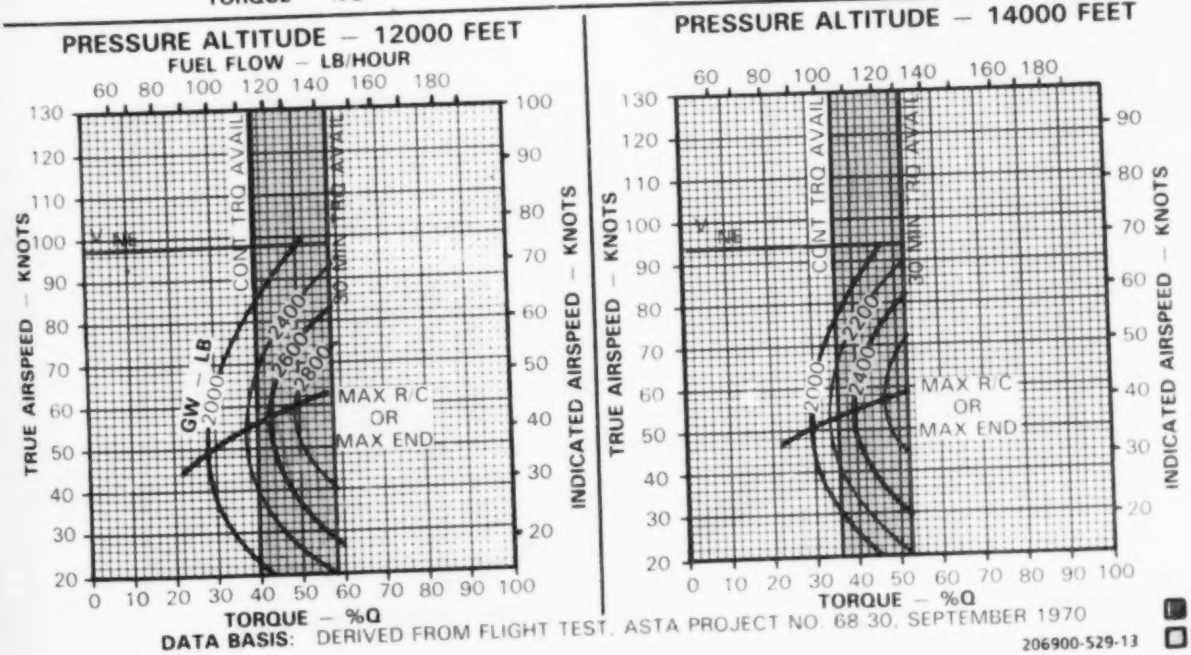
CRUISE

PRESSURE ALTITUDE — 8000 FEET TO 14000 FEET
CLEAN CONFIGURATION JP-4/JP-5 FUEL OGE
100%RPM

FAT = +45°C


PRESSURE ALTITUDE — 8000 FEET

PRESSURE ALTITUDE — 10000 FEET


PRESSURE ALTITUDE — 12000 FEET

PRESSURE ALTITUDE — 14000 FEET

DATA BASIS: DERIVED FROM FLIGHT TEST, ASTA PROJECT NO. 68 30, SEPTEMBER 1970

206900-529-13

Figure 7-15. Cruise Chart C (Sheet 13 of 13)

SECTION XIV. DRAG C

7-50. DESCRIPTION.

The drag chart (figure 7-16) shows the torque change required for flight due to drag area change as a result of external configuration changes. Note that the figure shows drag area change due to specific configurations.

7-51. USE OF CHART.

The primary use of the chart is illustrated by the example. To determine the change in torque it is necessary to know the drag area change, the true airspeed, the pressure altitude, and the free air temperature. Enter at the known drag area change, move right to TAS, move down to pressure altitude, move left to FAT, then move down and read change in torque. In addition, by entering the chart in the opposite direction, drag area change may be found from a known torque change.

This chart is used to adjust cruise charts (figure 7-15, sheets 1 through 13) for appropriate torque and fuel flow due to equivalent flat plate drag area change (Δ F).

7-52. CONDITIONS.

The drag chart is based upon 100% rpm.

DRAG

DRAG
OH-58C
T63-A-720

EXAMPLE

WANTED

CHANGE IN TORQUE REQUIRED DUE TO EQUIVALENT PLATE DRAG AREA CHANGE, (Δ F) FROM ALL DOORS OFF CONFIGURATION

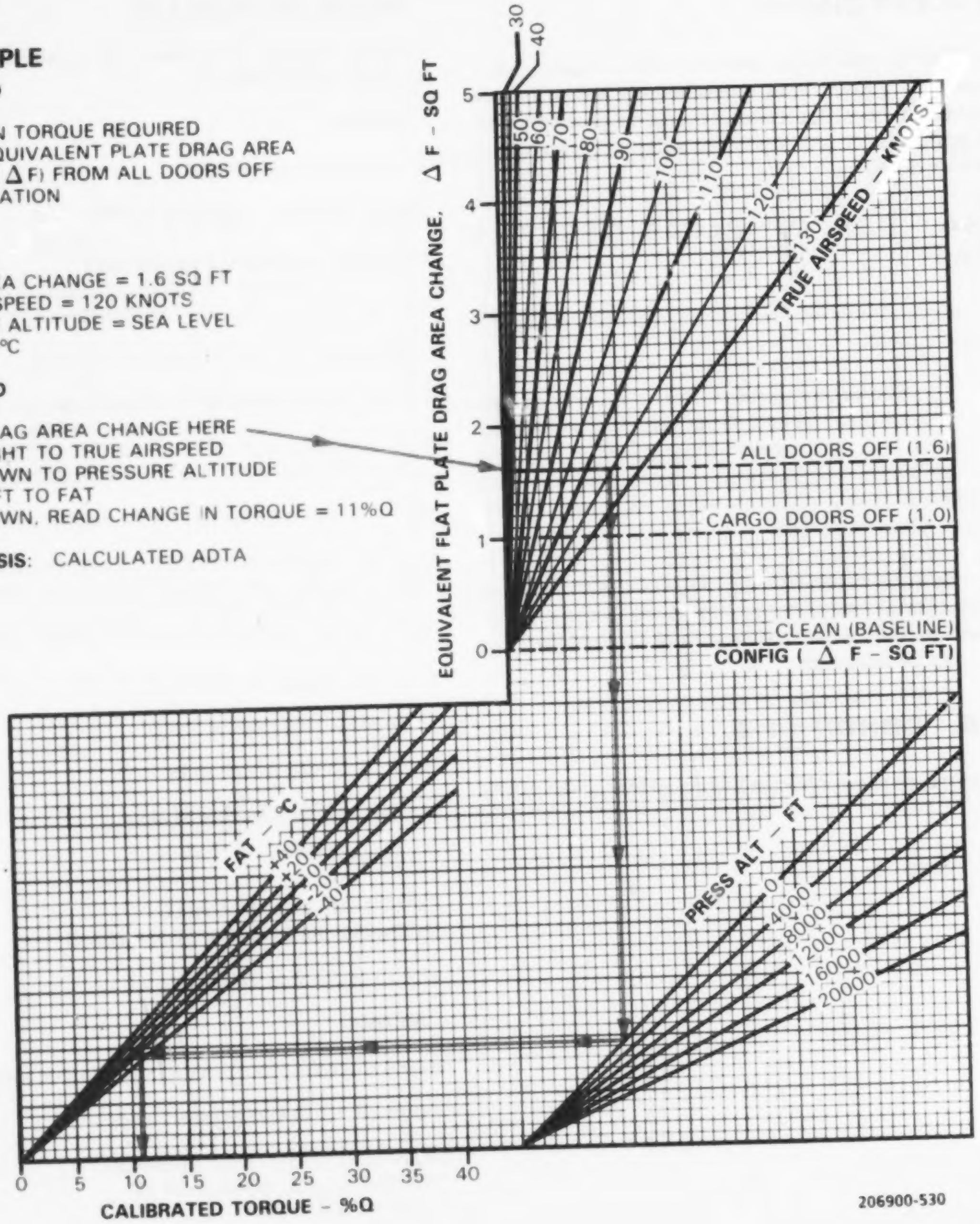
KNOWN

DRAG AREA CHANGE = 1.6 SQ FT
TRUE AIRSPEED = 120 KNOTS
PRESSURE ALTITUDE = SEA LEVEL
FAT = -20°C

METHOD

ENTER DRAG AREA CHANGE HERE
MOVE RIGHT TO TRUE AIRSPEED
MOVE DOWN TO PRESSURE ALTITUDE
MOVE LEFT TO FAT
MOVE DOWN, READ CHANGE IN TORQUE = 11%Q

DATA BASIS: CALCULATED ADTA



206900-530

Figure 7-16. Drag Chart C

SECTION XV. CLIMB — DESCENT C

7-53. DESCRIPTION — CLIMB-DESCENT CHART.

The grid of the climb descent chart (figure 7-17) shows the change in torque (above or below torque required for level flight under the same gross weight, and atmospheric conditions) to obtain a given rate of climb or descent.

7-54. USE OF CLIMB-DESCENT CHART.

The primary uses of the chart are illustrated by the chart examples.

a. The torque change obtained from the grid scale must be added to the torque required for level flight (for climb) — or subtracted from the torque required for level flight (for descent) — obtained from the appropriate cruise chart in order to obtain a total climb or descent torque.

b. By entering the bottom of the grid with a known torque change, moving upward to the gross weight, and left to the corresponding rate of climb or descent may also be obtained.

7-55. CONDITIONS.

The climb-descent chart is based on the use of 100% rpm.

EXAMPLE

WANTED (SEE FIGURE 7-15)

EXCESS TORQUE AVAILABLE FOR CLIMB AT MAXIMUM CONTINUOUS POWER

KNOWN

CLEAN CONFIGURATION

GROSS WEIGHT = 3200 LB

PRESSURE ALTITUDE = 14000 FEET

FAT = -30°C

METHOD

LOCATE CHART (FIGURE 7-15, SHEET 3)

FIND INTERSECTION OF 3200 LB GROSS WEIGHT LINE WITH THE MAXIMUM RATE OF CLIMB LINE → ①

MOVE DOWN, READ TORQUE REQUIRED = 53%Q

FIND INTERSECTION OF 3200 LB GROSS WEIGHT LINE WITH CONTINUOUS TORQUE AVAILABLE LINE → ②

MOVE DOWN, READ TORQUE AVAIABLE = 78%Q

EXCESS TORQUE AVAIABLE = (78-53) = 25%Q

WANTED (SEE FIGURE 7-17)

RATE OF CLIMB AT 70 KIAS

MAXIMUM CONTINUOUS POWER

KNOWN

EXCESS TORQUE AVALIABLE
(FROM FIGURE 7-15, SHEET 3) = 25% Q

GROSS WEIGHT = 3200 LB

METHOD

ENTER CALIBRATED TORQUE SCALE HERE → ③

MOVE UP TO GROSS WEIGHT LINE

MOVE LEFT TO RATE OF CLIMB OR DESCENT SCALE, READ RATE OF CLIMB = 1290 FT/MIN

CLIMB — DESCENT
100% RPM

EXAMPLE A

WANTED

CALIBRATED TORQUE CHANGE FOR DESIRED R/C OR R/D

KNOWN OR ESTIMATED

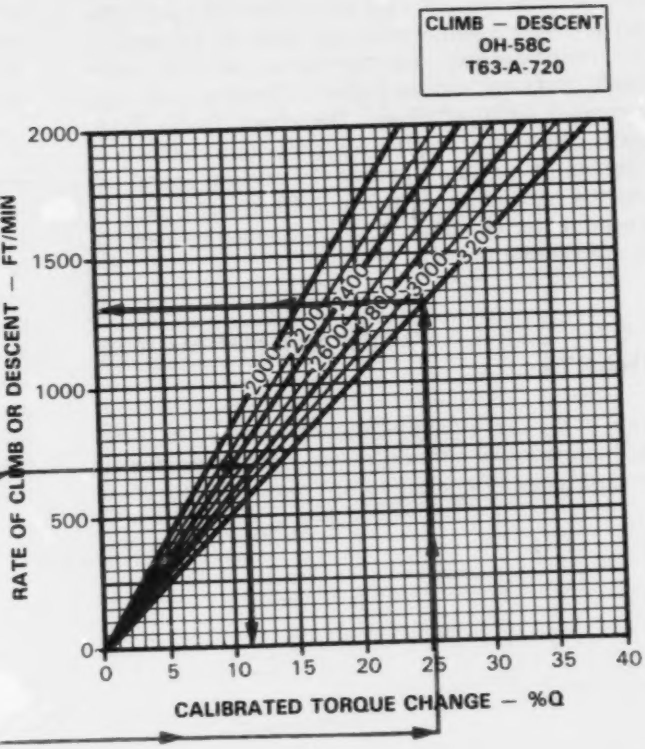
GROSS WEIGHT = 2600 LB
DESIRED R/C = 700 FT/MIN

METHOD

ENTER R/C HERE

MOVE RIGHT TO GROSS WEIGHT

MOVE DOWN, READ CALIBRATED TORQUE CHANGE = 11%Q



REMARK: TORQUE CHANGE IS THE DIFFERENCE BETWEEN THE TORQUE USED DURING THE CLIMB OR DESCENT AND THE TORQUE REQUIRED FOR LEVEL FLIGHT AT THE SAME CONDITIONS (ALTITUDE, GROSS WEIGHT, AIRSPEED, CONFIGURATION, ETC)

206900-531

Figure 7-17. Climb — Descent Chart C

7-56. DESCRIPTION — CLIMB PERFORMANCE CHARTS.

The climb performance charts (figure 7-18) represents a synthesis of the cruise charts to ease estimation of the climb portion of the flight plan. The charts show relationships between gross weight, initial and final altitude and temperatures, and time to climb, distance covered while climbing, and fuel expended while climbing. The chart (figure 7-18, sheet 1 of 2) is presented for (continuous operation) climbing at maximum torque (30 minute operation) and the second chart (figure 7-18, sheet 2 of 2) is presented for climbing. Both charts may be used for all drag configurations.

7-57. USE OF CLIMB PERFORMANCE CHARTS.

Enter at the top left at the known gross weight, move right to the initial altitude, move down to the free air temperature at that altitude, and move left and record time, distance, and fuel consumed for that altitude. Enter again at the gross weight, move right to the final altitude, move down to the free air temperature at that altitude, and move right and record the time, distance, and fuel for that altitude. Subtract the time, distance, and fuel values of the initial altitude-temperature condition from those of the final altitude-temperature condition to find the time to climb, distance covered and fuel used while climbing.

7-58. CONDITIONS — CLIMB PERFORMANCE CHARTS.

The charts represent climb at optimum condition, that is minimum power required and stated torque available. Climb is assumed to be at 50 knots IAS as this is near the airspeed for maximum rate of climb at most atmospheric conditions. Warmup and taxi fuel are not included in fuel flow calculations. Climb performance is calculated for 100% rpm. The charts are based upon a no-wind condition, therefore, distance traveled will not be valid when winds are present.

CLIMB
OH-58C
T63-A-720

CLIMB PERFORMANCE
(MAXIMUM TORQUE AVAILABLE — 30 MINUTE OPERATION)
100% RPM CLIMB AT 50 KIAS

EXAMPLE

WANTED

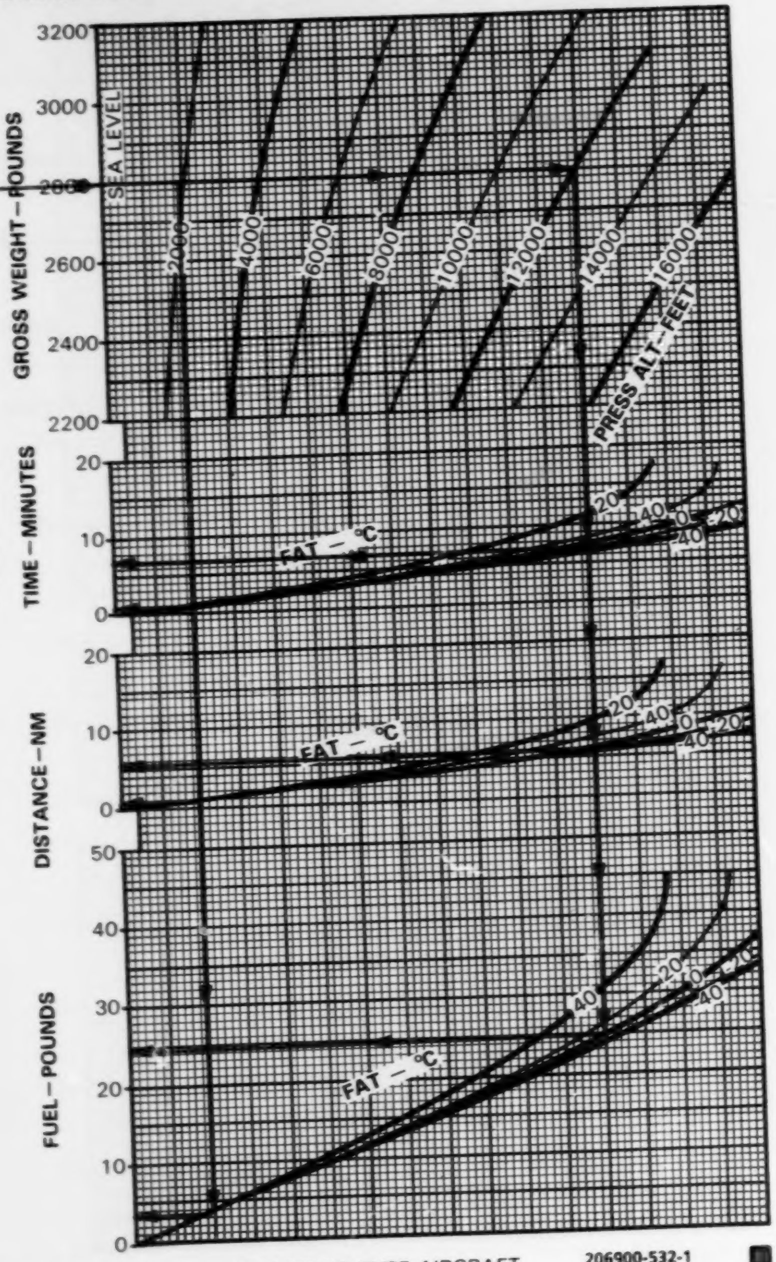
MAXIMUM POWER
TIME TO CLIMB
DISTANCE TRAVELED
FUEL USED

KNOWN

GROSS WEIGHT = 2800 LBS
INITIAL PRESSURE ALTITUDE = 2000 FEET
FINAL PRESSURE ALTITUDE = 12000 FEET
INITIAL FAT = -20°C
FINAL FAT ESTIMATED AT 0°C

METHOD

ENTER GROSS WEIGHT HERE
MOVE RIGHT TO INITIAL PRESSURE ALTITUDE
MOVE DOWN TO INITIAL FAT ON
TIME, DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:
TIME = 1.0 MIN
DISTANCE = 1.0 NM
FUEL = 4.0 LB
REENTER AT SAME GROSS WEIGHT
MOVE RIGHT TO FINAL PRESSURE ALTITUDE
MOVE DOWN TO FINAL FAT, ON TIME,
DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:
TIME = 7.5 MIN
DISTANCE= 6.4 NM
FUEL = 25.0 LB
TIME TO CLIMB =(7.5 - 1.0) = 6.5 MIN
DISTANCE COVERED =(6.4 - 1.0) = 5.4 NM
FUEL USED =(25.0 - 4.0) = 21.0 LB



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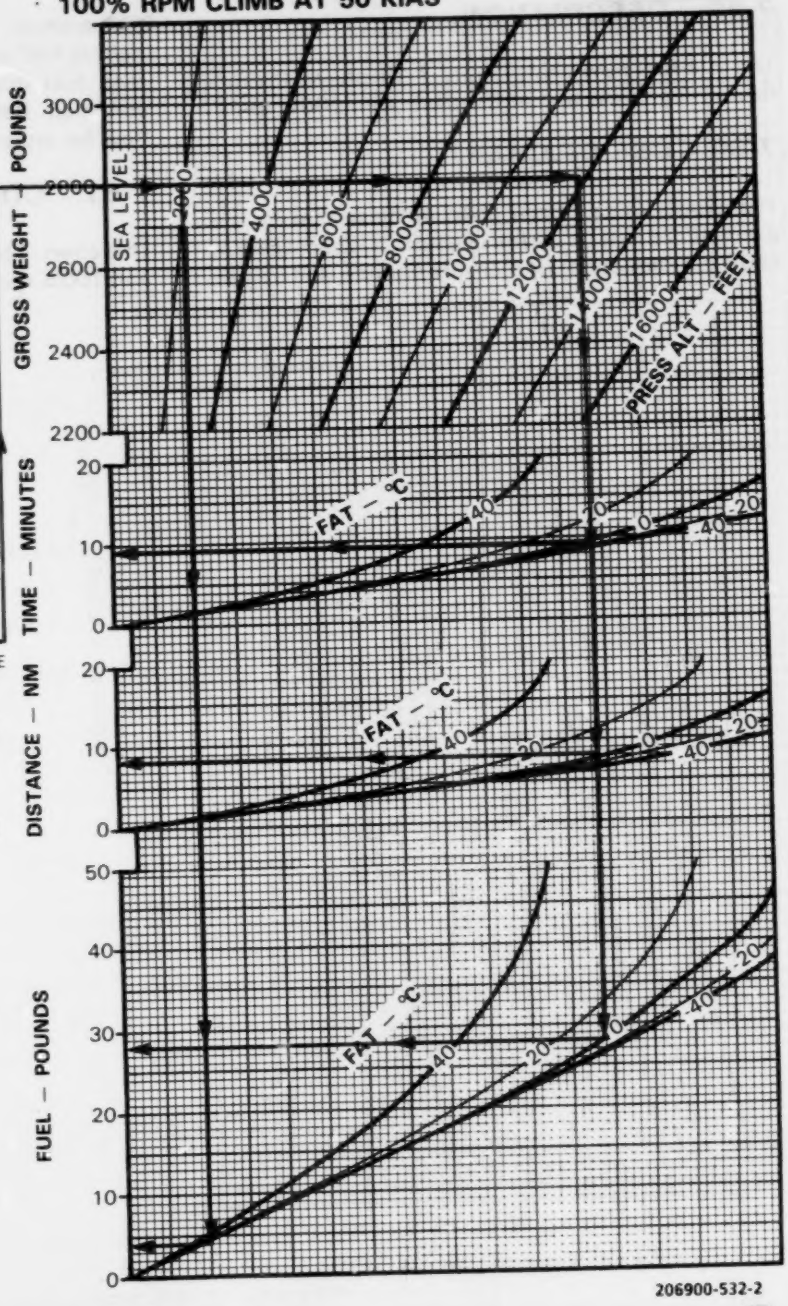
DATA BASIS: DERIVED FROM FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

Figure 7-18. Climb Performance C (Sheet 1 of 2)

CLIMB PERFORMANCE
(CONTINUOUS OPERATION)
100% RPM CLIMB AT 50 KIAS

CRUISE
OH-58C
T63-A-720



EXAMPLE

WANTED

CONTINUOUS POWER
TIME TO CLIMB
DISTANCE TRAVELED
FUEL USED

KNOWN

GROSS WEIGHT = 2800 LBS
INITIAL PRESSURE ALTITUDE = 2000 FEET
FINAL PRESSURE ALTITUDE = 12000 FEET
INITIAL FAT = 20°C
FINAL FAT ESTIMATED AT 0°C

METHOD

ENTER GROSS WEIGHT HERE
MOVE RIGHT TO INITIAL PRESSURE ALTITUDE
MOVE DOWN TO INITIAL FAT ON
TIME, DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:
TIME = 1.3 MIN
DISTANCE = 1.0 NM
FUEL = 4.7 LB
REENTER AT SAME GROSS WEIGHT
MOVE RIGHT TO FINAL PRESSURE ALTITUDE
MOVE DOWN TO FINAL FAT, ON TIME,
DISTANCE, AND FUEL CHARTS
MOVE LEFT, READ:
TIME = 9.6 MIN
DISTANCE = 8.0 NM
FUEL = 28.7 LB
TIME TO CLIMB =(9.6 - 1.3) = 8.3 MIN
DISTANCE COVERED =(8.0 - 1.0) = 7.0 NM
FUEL USED =(28.7 - 4.7) = 24.0 LB

206900-532-2

C

DATA BASIS: DERIVED FROM FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

Figure 7-18. Climb Performance **C** (Sheet 2 of 2)

SECTION XVI. IDLE FUEL FLOW C

7-59. DESCRIPTION.

The idle fuel flow chart (figure 7-19) shows the fuel flow at flight idle and at flat pitch with 100% rpm.

7-60. USE OF CHART.

The primary use of the chart is illustrated by the example. To determine the idle flow, it is necessary to know the idle condition, pressure altitude, and free air temperature. Enter at the pressure altitude, move right to FAT in appropriate grid, then move down and read fuel flow on the scale corresponding to the condition. Refer to the cruise charts to obtain fuel flow for cruise power conditions.

7-61. CONDITIONS.

This chart is based upon the use of JP-4 or JP-5 fuel and 100% rpm.

IDLE FUEL FLOW
JP-4 FUEL

IDLE FUEL FLOW
OH-58C
T63-A-720

EXAMPLE

WANTED

FUEL FLOW AT FLAT PITCH
AND ENGINE IDLE

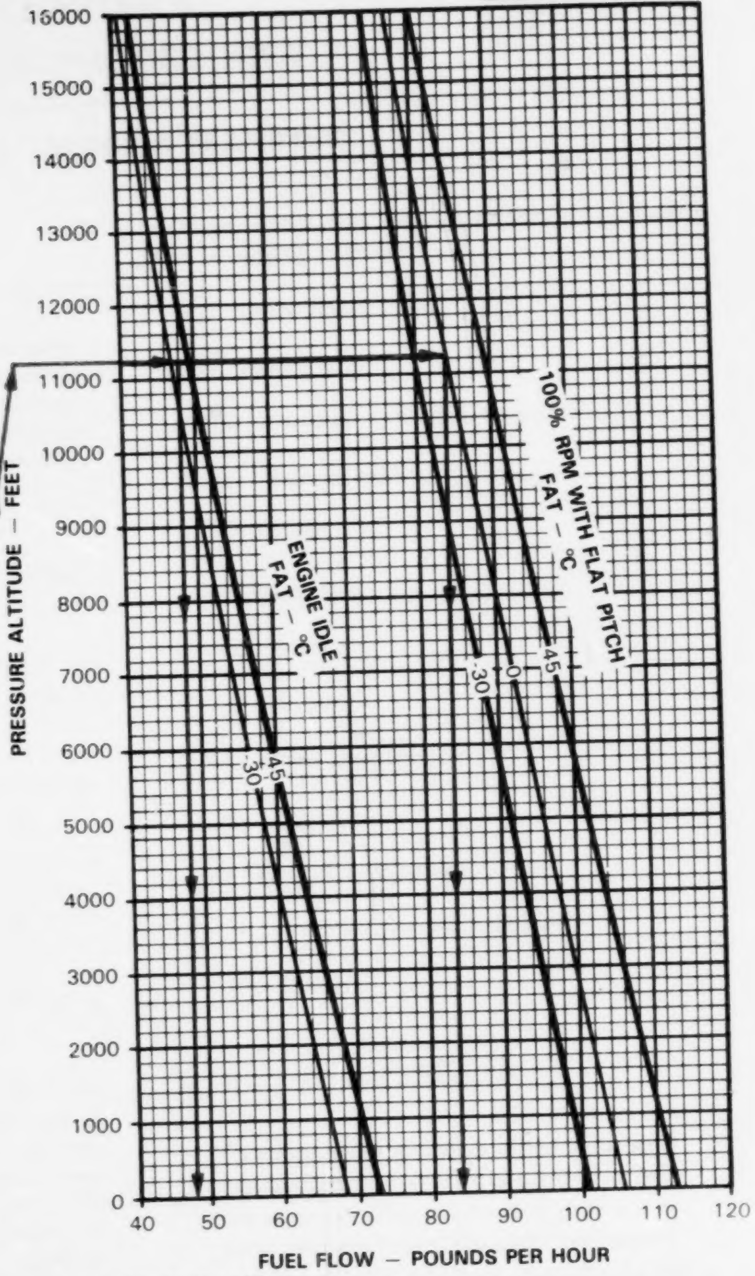
KNOWN

PRESSURE ALTITUDE = 11200 FEET

FAT = 0°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO (FLAT PITCH)
FAT = 0°C
MOVE DOWN, READ FLAT PITCH
FUEL FLOW = 84 LB/HR
REENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO (ENGINE IDLE)
FAT = 0°C
MOVE DOWN READ ENGINE IDLE
FUEL FLOW = 48 LB/HR



DATA BASIS: CALCULATED FROM MODEL SPEC 876, 25 JULY 1975, CORRECTED FOR INSTALLATION LOSSES BASED ON FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

206900-533

Figure 7-19. Idle Fuel Flow Chart C

CHAPTER 8

NORMAL PROCEDURES

SECTION I. MISSION PLANNING

8-1. MISSION PLANNING.

Mission planning begins when the mission is assigned and extends to the preflight check of the helicopter. It includes, but is not limited to, checks of operating limits and restrictions; weight, balance and loading; performance; publications; flight plan; and crew and passenger briefings. The pilot shall ensure compliance with the contents of this manual which are applicable to the mission.

8-2. AVIATION LIFE SUPPORT EQUIPMENT (ALSE).

All aviation life support equipment required for mission; e.g., helmets, gloves, survival vests, survival kits, etc., shall be checked.

8-3. CREW DUTIES/RESPONSIBILITIES.

The minimum crew required to fly the helicopter is a pilot. During single pilot operations, the pilot shall occupy the right-hand pilot seat. Additional crew members, as required, may be added at the discretion of the commander. The manner in which each crew member performs his duties is the responsibility of the pilot in command.

a. **Crew Briefing.** A crew briefing shall be conducted to ensure a thorough understanding of individual and team responsibilities. The briefing should include, but not be limited to, copilot, crew chief, mission equipment operator, ground crew responsibilities, and the coordination necessary to complete the mission in the most efficient manner. A review of visual signals is desirable when ground guides do not have voice communication with the crew.

b. **Passenger Briefing.** The following guide may be used in accomplishing required passenger briefings; items that do not pertain to a specific mission may be omitted.

(1) Crew introduction.

(2) Equipment.

  (a) Personal to include ID tags.

  (b) Professional.

  (c) Survival.

(3) Flight data.

  (a) Route.

  (b) Altitude.

  (c) Time enroute.

  (d) Weather.

(4) Normal procedures.

  (a) Entry and exit of helicopter.

  (b) Seating.

WARNING

Demonstrate to passenger how and where loose carry-on equipment will be secured. Demonstrate to passenger how seat belts and shoulder harnesses are to be used and how they are to be secured when exiting.

  (c) Seat belts.

  (d) Movement in the helicopter.

(e) Internal communication.

(f) Security of equipment.

(g) Smoking.

(h) Oxygen.

(i) Refueling.

(j) Weapons.

(k) Protective masks.

(l) Parachutes.

(m) Hearing protection.

(n) Aviation life support equipment (ALSE).

(5) Emergency procedures.

(a) Emergency exits.

(b) Emergency equipment.

(c) Emergency landing/ditching procedures.

(d) Bail out.

(e) Survival.

(f) Recovery.

SECTION II. OPERATING PROCEDURES AND MANEUVERS

8-4. OPERATING PROCEDURES AND MANEUVERS.

This section deals with normal procedures and includes all steps necessary to ensure safe, efficient operation of the helicopter from the time a preflight begins until the flight is completed and the helicopter is parked and secured. Unique feel, characteristics, and reaction of the helicopter during various phases of operation and the techniques and procedures used for taxiing, takeoff, climb, etc., are described, including precautions to be observed. Your flying experience is recognized; therefore, basic flight principles are avoided. Only the duties of the minimum crew necessary for the actual operation of the helicopter are included. Additional crew duties are covered as necessary in Section I. Mission equipment checks are contained in Chapter 4, MISSION EQUIPMENT. Procedures specifically related to instrument flight that are different from normal procedures are covered in this section, following normal procedures. Descriptions of functions, operations, and effects of controls are covered in Section IV, FLIGHT CHARACTERISTICS, and are repeated in this section only when required for emphasis. Checks that must be performed under adverse environmental conditions, such as desert and cold-weather operations, supplement normal procedures checks in this section and are covered in Section V, ADVERSE ENVIRONMENTAL CONDITIONS.

8-5. SYMBOLS DEFINITION.

Items which apply only to night or only to instrument flying shall have an "N" or an "I," respectively, immediately preceding the check to which it is pertinent. The symbol "O" shall be used to indicate "if installed." Those duties which are the responsibility of the copilot, will be indicated by a circle around the step number; i.e., ④ . The symbol star "★" indicates that a detailed procedure for the step is located in the Performance section of the condensed checklist. The symbol asterisk "*" indicates that performance of step is mandatory for all thru-flights. The asterisk applies only to checks performed prior to takeoff. Placarded items such as switch and control labels appear in capital letters.

8-6. CHECKLIST.

Normal procedures are given primarily in checklist form, and amplified as necessary in accompanying paragraph form, when a detailed description of a procedure or maneuver is required. A condensed version of the amplified checklist, omitting all explanatory text, is contained in the operator's checklist. To provide for easier cross-referencing, the procedural steps in the condensed checklist are numbered to coincide with the corresponding numbered steps in this manual.

8-7. PREFLIGHT CHECK.

The pilot walk-around and interior checks are outlined in the following procedures. The preflight check is not intended to be a detailed mechanical inspection. The steps that are essential for safe helicopter operation are included. The preflight may be made as comprehensive as conditions warrant at the discretion of the pilot.

8-8. BEFORE EXTERIOR CHECKS.

WARNING

Do not preflight until armament systems are safe.

O* 1. Armament system — Safe as follows:

O* a. Ground safety pins in, safing devices installed, and gun clear.

O* b. ARMAMENT SAFE switch — SAFE.

O* c. ARMAMENT MASTER switch — OFF.

2. Publications — Check DA Forms 2408-12, -13, -14, and -18; DD Form 1896 if required; DD Form 365-4; Compass Cards; locally required forms, records and publications; and availability of operator's manual (-10) and checklist (-CL).

*3. Covers, locking devices, tiedowns (except main rotor), and grounding cables — Removed and secured.

*4. Ignition switch — On.

5. Cockpit — Check as follows:

a. FUEL BOOST switch — OFF.

b. BAT switch — BAT. (Check fuel quantity.)

c. NON-ESS BUS switch — MAN.

d. Lights — Check and set if use is anticipated. (LDG, ANTI-COLLISION, POS, CONSOLE, INST, and NVG lights.)

e. WARNING and CAUTION lights — Check for illumination of the ROTOR RPM, MASTER CAUTION, ENGINE OUT, and XMSN OIL PRESS lights. Press the WARNING LTS TEST switch to check XMSN OIL HOT light. Test caution lights and reset. DC GENERATOR, HYD PRESS, and INST INVERTER caution lights should remain illuminated. Do not fly if any of these lights fail to illuminate.

f. BAT switch — OFF.

g. Pilot seat, seat belt, shoulder harness, and armor side panels — Check condition.

O h. Crew door — Check condition.

8-9. EXTERIOR CHECK.

8-10. AREA 1 (figure 8-1) — FUSELAGE — CABIN RIGHT SIDE.

1. Cabin interior — Check as follows:

O* a. Cargo/loose equipment — Check for proper loading and tiedown.

O* b. Auxiliary fuel cell — Check condition, fuel level, and cap secure.

*c. Passenger seats and belts — Check as follows:

(1) Check seat and back cushions for condition and security. Ensure seat belts are through loops on seat and back cushions and secured with nylon safety cord.

(2) Check tabs on top of seat back for condition and security.

(3) Check seat belts and shoulder harnesses for condition and security. Ensure shoulder harnesses and belts are properly fastened together and tightened when not in use.

(4) If seat belts are not installed, seat and back cushions must be removed prior to flight with doors off.

d. First aid kit — Check.

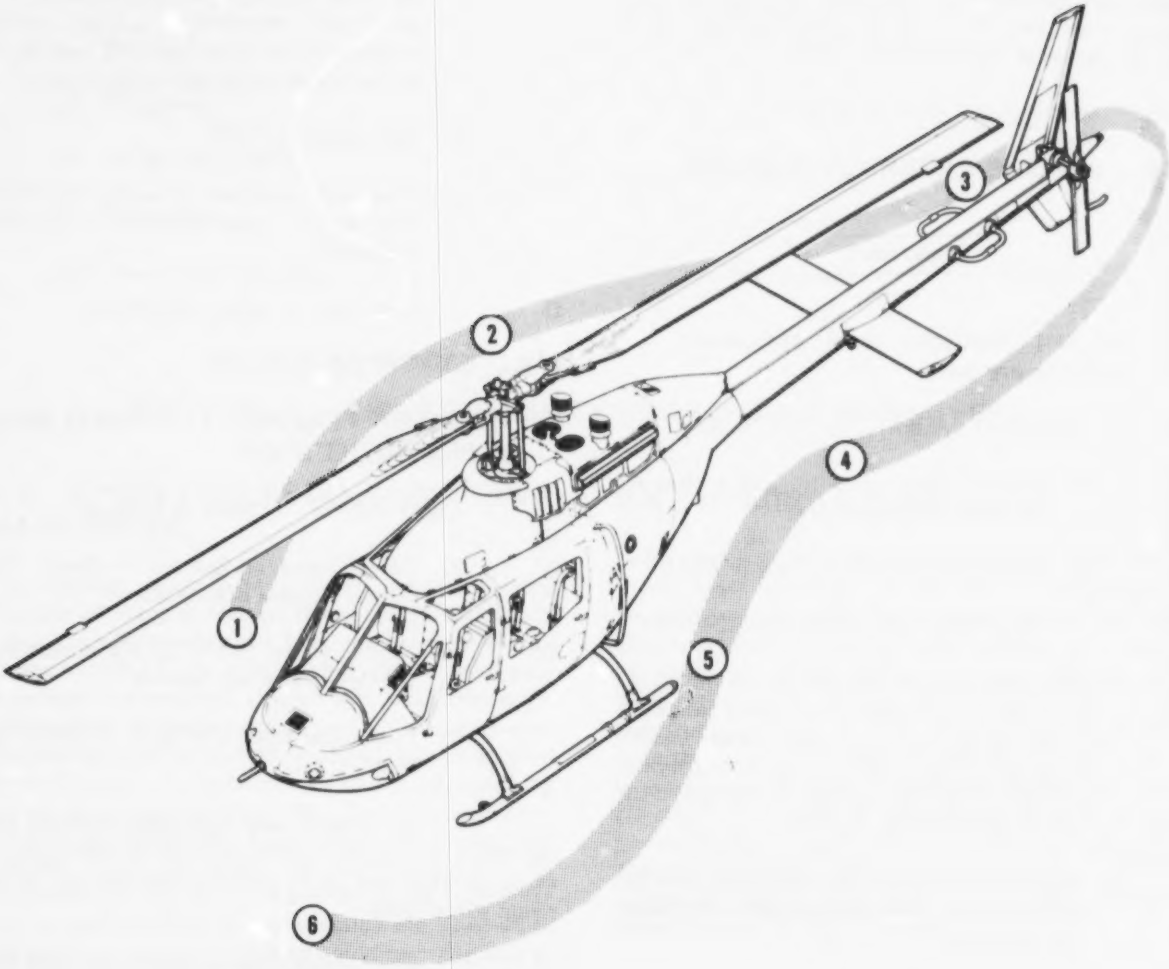


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Figure 8-1. Exterior Check Diagram

e. Fire extinguisher — Check.

O f. Cabin door — Check condition.

2. Fuselage — Check as following items are checked:

a. Static port — Check unobstructed.

b. Landing gear — Check condition of crosstubes, skid, skid shoe(s), wheels removed.

c. Fuel sample — Check for contamination before first flight of the day. If the fuel sump has not been drained, drain a sample and check.

*d. Hydraulic reservoir/servos and flight controls — Check condition and oil level. Hydraulic filter buttons in. Secure door.

*e. Transmission compartment — Check condition and oil level. Secure door.

f. Engine inlet and plenum — Check clear.

g. Engine compartment — Check condition; lines, cables, and connections for condition and leaks. Secure door.

*h. Fuel — Check quantity first flight of day and when refueled. Cap secure.

i. FM homing antenna — Check condition.

j. Drain lines and vents — Check unobstructed.

k. Transmission and engine cowling — Check secure.

l. Engine oil tank — Check condition, cap secure. Secure door.

8-11. AREA 2 (figure 8-1) — TAILBOOM — RIGHT SIDE.

1. Tailboom — Check as following items are checked:

O a. Driveshaft cover — Check secure.

b. Tail rotor drive — Check shaft, collars, bearings, and hangers for condition, slippage marks (if cover not installed).

c. Horizontal stabilizer — Check condition.

d. Vertical fin — Check condition; antenna connections secure.

e. Tail skid — Check condition.

*2. Main rotor blade — Check condition, rotate 90 degrees to fuselage, tiedown removed.

8-12. AREA 3 (figure 8-1) — TAILBOOM — LEFT SIDE.

*1. Tail rotor gearbox — Check condition, oil level, filler cap, and chip detector wire secure.

*2. Tail rotor — Check condition.

3. Tailboom — Check as following items are checked:

O a. Driveshaft cover — Check secure.

b. Horizontal stabilizer — Check condition.

8-13. AREA 4 (figure 8-1) — AFT FUSELAGE — LEFT SIDE.

1. Fuselage — Check as following items are checked:

a Oil tank compartment — Check condition of oil cooler, driveshaft, and oil lines. Secure door.

*b. Engine oil level — Check.

c. Avionics compartment — Check condition of components and tailboom slippage marks. Secure door.

d. Engine compartment — Check condition, lines, and connections for security and leaks. Secure door.

e. FM homing antenna — Check condition.

f. Transmission compartment — Check condition. Secure door.

g. Hydraulic servos and flight controls — Check.

2. Main rotor blade — Check condition.

8-14. AREA 5 (figure 8-1) — FUSELAGE — CABIN LEFT SIDE.

1. Fuselage top — Check as following items are checked:

a. Engine inlet and plenum — Check clear.

b. Engine oil cooler exhaust — Check condition.

c. Engine exhaust — Check.

d. Hydraulic reservoir, lines, slippage marks, and flight controls — Check.

e. Transmission oil filler — Check cap secure.

f. Transmission oil cooler exhaust — Check condition.

g. Cowling — Check secure.

NOTE

Ensure swashplate is level for inspection of outer-ring self-aligning bearings for main rotor push-pull tubes.

*2. Main rotor system — Check condition, slippage marks, level of fluid in grip and pillow block reservoirs (if installed), swashplate, and flight controls.

3. Fuselage — Check as following items are checked:

O* a. Mission equipment — Check weapons and/or other mission equipment.

O b. Cabin door — Check condition.

c. Landing gear — Check condition, cross tubes, skid, skid shoe(s). Wheels removed.

4. Cockpit — Check as follows:

a. Copilot seat, seat belts, shoulder harness, and armor side panels (if installed). Check condition. Secure seat belts and shoulder harness if seat is not used.

b. Cyclic — Check secure or stow as required, cannon plug connected.

c. Collective — Check secure or stow as required.

O d. Crew door — Check condition.

8-15. AREA 6 (figure 8-1) — FUSELAGE — FRONT.

1. Fuselage — Check as following items are checked:

a. Static port — Check.

b. Upper WSPS — Check.

c. Windshield — Check.

d. Ram air grill — Check.

e. Pitot tube — Check.

f. Lower WSPS — Check.

g. Fuselage underside — Check.

★ *2. Crew and passenger briefing — Complete as required. Refer to crew and passenger briefings in Section I.

8-16. BEFORE STARTING ENGINE.

★ *1. Armament system — Check and set.

2. Shoulder harness lock(s) — Check operation.

3. Overhead switches and circuit breakers — Set as follows:

a. Cockpit utility and NVG lights — As required.

b. Circuit breakers — In.

c. INST LTS, CONSOLE LTS, and NVG switches — As required.

*d. ANTI-COLLISION LTS switch — As required.

*3. POS LTS switch — As required.

f. ENG OIL **A**, (ENG OIL BYPASS **C**) switch — OFF. In a combat situation with the possibility of oil cooler damage, the switch should be in AUTO.

g. HTR switch — OFF.

h. DEFOG & VENT switch — OFF.

i. PITOT HTR switch — OFF.

j. ENG DEICE switch — OFF.

k. INV switch — OFF.

l. NON-ESS BUS switch — MAN.

m. GEN switch — OFF.

*n. BAT switch — As required. BAT for battery start; OFF for GPU start.

o. AUX RECP switch — OFF.

p. Fuel valve handle — Check ON (forward).

q. FAT gage — Check.

*4. GPU — Connect for GPU start.

5. Avionics — Off and set.

6. Instrument panel instruments and switches — Check and set as follows:

a. Systems instruments — Check engine instruments for static indications, slippage marks, and operating range limit markings.

b. Flight instruments — Check.

c. DIR GYRO/MAG switch — As required.

d. FORCE TRIM switch — FORCE TRIM.

e. HYD BOOST switch — HYD BOOST.

*7. Flight controls — Check and set as follows:

a. Control frictions — Off.

b. Flight controls — Check for full travel; check engine out/low-rotor audio.

*8. Throttle — Check. Move to open, then to idle stop; press idle release and close.

8-17. STARTING ENGINE.

*1. Fireguard — Post if available.

*2. Rotor blades — Check clear and untied.

★ *3. Engine — Start as follows:

a. FUEL BOOST switch — FUEL BOOST.

b. STARTER switch — Press and hold.

c. TOT — Check below 200 degrees C.

d. Throttle — Open to engine idle at peak of N1 RPM, provided the following limits are maintained:

	FAT	MINIMUM N_1
(1)	7°C and above	15%
(2)	7°C thru -18°C	13%
(3)	-18°C and below	12%

e. Main rotor — Check moving by 30 percent N_1.

f. TOT — Monitor for over-temperature conditions.

g. STARTER switch — Release at 58-62 percent N_1.

h. Engine oil pressure — Check.

i. ENGINE OUT and XMSN OIL PRESS warning lights — Check out.

j. N_1 — 62-64 percent.

*4. GPU — Disconnect; then — BAT switch — BAT.

*5. GEN switch — GEN.

*6. DC amps — Check 60 or less before inverter is turned on.

*7. INV switch — INV.

*8. Avionics — On.

8-18. ENGINE RUNUP.

*1. Engine and transmission instruments — Check.

*2. Throttle — Slowly increase to open. Set N2 103 percent A , (100 percent C).

3. HEAT and DEICE systems — Check if use is anticipated as follows, then set as required.

   a. ENG DEICE — Check by moving the switch to ENG DEICE; check for rise in TOT; then OFF. TOT should decrease.

   b. PITOT HTR — Check by moving the switch to PITOT HTR; check for an increase in DC AMPS; then OFF. DC AMPS should decrease.

   c. DEFOG & VENT — Check by moving the switch to DEFOG & VENT; check for an increase in DC AMPS; then OFF. DC AMPS should decrease.

   d. HTR — Check by moving the switch to HTR; check for increase in TOT; then OFF. TOT should decrease.

4. Avionics — Check as required.

*5. Flight instruments — Check and set as follows.

   a. Attitude indicator — Set.

   b. Altimeter — Set and compare altitude with field elevation.

   c. Heading indicators — Check and set.

*6. Doors, armor side panels, and seat belts — Secure.

7. Health indicator test (HIT) — Check — Refer to HIT TOT log in the helicopter log book. Perform before first flight of the day.

★ 8. Deceleration check — Perform if required. See Chapter 5, FUEL OPERATION LIMITS — Alternate Fuel as follows:

   a. N2 RPM — 103 percent A , (100 percent C) stabilize 15 seconds.

   b. Throttle — Idle. Simultaneously start a time count.

   c. Stop time as N1 passes through 65 percent.

NOTE

Multiple attempts may be required before proficiency is obtained in timing the deceleration.

   d. Check deceleration time. Minimum allowable time is 2 seconds. If deceleration time is less than 2 seconds, make two checks to confirm the time.

   e. If deceleration time is less than 2 seconds, aircraft will not be flown. Enter conditions in "Remarks" section on DA Form 2403-13.

8-19. HOVER CHECK.

Perform the following checks at a hover:

1. Flight controls — Check.

2. Engine and transmission instruments — Check.

3. Power — Check. The power check is performed by comparing the torque required to hover with the predicted values from performance charts.

4. Flight instruments — Check as required.

8-20. BEFORE TAKEOFF.

Prior to takeoff, the following checks shall be accomplished:

*1. N2 — 103 percent A, (100 percent C).

*2. Systems — Check engine, transmission, electrical, and fuel systems indications.

*3. Crew, passengers, mission equipment, and seat belts — Check.

*4. Avionics — As required.

8-21. TAKEOFF.

CAUTION

During takeoff with the helicopter skids close to the ground, nose-low attitudes of 10 degrees or more can result in ground contact of the WSPS lower cutter tip. Forward CG, high gross weight, high density altitude, translational lift settling, and tail wind increses the possibility of ground contact.

8-22. MAXIMUM PERFORMANCE.

A takeoff that demands maximum performance from the helicopter is necessary because of various combinations of heavy helicopter loads, restricted performance due to high density altitudes, barriers that must be cleared, and other terrain features. The decision to use either of the following takeoff techniques must be based on an evaluation of the conditions and helicopter performance.

a. **Coordinated Climb**. Align the helicopter with the desired takeoff course at a stabilized hover of approximately 3 feet (skid height). Apply forward cyclic pressure smoothly and gradually while simultaneously increasing collective to begin a coordinated acceleration and climb. Adjust pedal pressure as necessary to maintain the desired heading. Maximum torque available should be applied (without exceeding helicopter limits), as the helicopter attitude is established that will permit safe obstacle clearance. The climbout is continued at that attitude and power setting until the obstacle is cleared. After the obstacle is cleared, adjust helicopter attitude and collective as required to establish a climb at the desired rate and airspeed. Continuous coordinated application of control pressures is necessary to maintain trim, heading, flight path, airspeed, and rate of climb. Takeoff may be made from the ground, by positioning the cyclic control slightly forward of neutral prior to increasing collective.

b. **Level Acceleration.** Align the helicopter with the desired takeoff course at a stabilized hover of approximately 3 feet (skid height). Apply forward cyclic pressure smoothly and gradually while simultaneously increasing collective pitch to begin an acceleration at approximately 3 to 5 feet skid height. Adjust pedal pressure as necessary to maintain the desired heading. Maximum torque available should be applied (without exceeding helicopter limits) prior to accelerating through effective translational lift. Additional forward cyclic pressure will be necessary to allow for level acceleration to the desired climb airspeed. Approximately 5 knots prior to reaching the desired climb airspeed, gradually release forward cyclic pressure and allow the helicopter to begin a constant airspeed climb to clear the obstacle. Care must be taken not to decrease airspeed during the climbout, since this may result in the helicopter descending (falling through). After the obstacle is cleared, adjust helicopter attitude and collective, as required, to establish a climb at the desired rate and airspeed. Continuous coordinated application of control pressures is necessary to maintain trim, heading, flight path, airspeed, and rate of climb. Takeoff may be made from the ground by positioning the cyclic control slightly forward of neutral, prior to increasing collective.

c. **Comparison of Techniques.** Refer to Chapter 7, PERFORMANCE DATA, for a comparison of takeoff distances. Where the two techniques yield the same distance over a 50 foot obstacle, the coordinated climb technique will give a shorter distance over lower obstacles and the level acceleration technique will give you a shorter distance over obstacles higher than 50 feet. The two techniques give approximately the same distance over a 50 foot obstacle, when the helicopter can barely hover OGE. As hover capability is decreased, the level acceleration technique gives increasingly shorter distances than the coordinated climb technique. In addition to the distance comparison, the main advantages of the level-acceleration technique are as follows:

(1) It requires less or no time in the avoid area of the height velocity diagram.

(2) Performance is more repeatable, since reference to attitudes which change with loading and airspeed is not required.

(3) At the higher climbout airspeeds (30 knots or more), reliable indicated airspeeds are available for accurate airspeed reference from the beginning of the climbout, therefore minimizing the possibility of fall-through. The main advantage of coordinated climb technique is that the climb angle is established early in the takeoff and more distance and time are available to abort the takeoff, if the obstacle cannot be cleared. Additionally, large attitude changes are not required to establish the climb airspeed.

8-23. BEFORE LANDING.

Prior to landing, the following checks shall be accomplished:

Crew, passenger, and mission equipment — Check.

8-24. ENGINE SHUTDOWN.

CAUTION

If the throttle is inadvertently rolled to the close position, do not attempt to roll it back on.

1. Throttle — Engine idle for two minutes.
2. FORCE TRIM switch — FORCE TRIM.
3. FUEL BOOST switch — OFF.
4. LDG LTS A , (LDG LT C) — OFF.
5. Control frictions — On.
6. Avionics — OFF.
7. Overhead switches and circuit breakers — Set as follows:
    a. ENG OIL A , (ENG OIL BYPASS C) switch — OFF.
    b. HTR switch — OFF.
    c. DEFOG & VENT switch — OFF.
    d. PITOT HEAT — OFF.
    e. ENG DEICE switch — OFF.
    f. INV switch — OFF.
8. Battery charge — Check as follows:
    a. BAT switch — OFF.
    b. Ammeter — Check change in indication. If the change in indication is less than 5.0 amperes, the battery is fully charged.
    c. BAT switch — BAT.
9. Throttle — Close. TOT, stabilize below 400°C.
10. Overhead switches — OFF as required.
    a. GEN.
    b. ANTI-COLLISION LTS.
    c. POS LTS.
    d. CONSOLE LTS and INST LTS.
    e. BAT.
11. Ignition switch — Off. (Keys as required.)

CAUTION

Do not drop seat belt against side of aircraft. Buckles and bracket will damage honeycomb panel under crew member doorframe.

O 12. Doors — Close immediately after exiting aircraft.

8-25. BEFORE LEAVING THE HELICOPTER.

1. Main rotor blades — Tie down as required.
2. Walk-around — Complete, checking for damage, fluid leaks, and levels.
3. Mission equipment — Secure.
4. Complete DA Forms 2408-12 and -13.
5. Secure helicopter — As required.

SECTION III. INSTRUMENT FLIGHT

8-26. INSTRUMENT FLIGHT — GENERAL.

This aircraft is restricted to visual flight conditions. Flight into instrument meteorological conditions will be conducted on an emergency basis only. Flight handling, stability characteristics, and range are the same during instrument flight as for visual flight. Navigation and communication equipment are adequate for instrument flight.

SECTION IV. FLIGHT CHARACTERISTICS

8-27. OPERATING CHARACTERISTICS.

a. The flight characteristics of this helicopter, in general, are similar to other single-rotor helicopters.

b. N2 droop may occur during a normal flight maneuver requiring a rapid increase in power (i.e., rapid collective and/or tail rotor inputs, high-G maneuvers). If N2 droop occurs, but low RPM warning is not activated and N2 recovers to 103 percent **A**, (100 percent **C**) within 5 seconds and further droop is not experienced, this is considered a normal flight characteristic.

8-28. MAST BUMPING.

Mast bumping (flapping-stop contact) is the main yoke contacting the mast and may result in a fractured mast and rotor separation. It may occur during slope landings, rotor startup/coastdown, or when the flight envelope is exceeded. If bumping occurs during a slope landing, reposition the cyclic to stop the bumping, reestablish a hover, and land on less sloping ground. If bumping occurs during startup or shutdown, move cyclic to minimize or eliminate bumping. If the flight envelope is inadvertently exceeded, causing a low "G" condition and right roll, move cyclic aft to return rotor to a positive thrust condition, then roll level, continuing flight if mast bumping has not occurred. As collective pitch is reduced after engine failure or loss of tail rotor thrust, cyclic must be positioned to maintain positive "G" forces during autorotation. Touchdown should be accomplished prior to excessive rotor RPM decay. After landing, an entry in DA Form 2408-13 is required for appropriate maintenance inspection.

8-29. SPIKE KNOCK.

a. Spike knock occurs when the round pin in the drag-pin fitting contacts the side of the square hole of the pylon stop, which is mounted to the roof. It creates a loud noise and will occur during a rocking of the pylon. The following factors can cause spike knock, low rotor RPM, extreme asymmetric loading, poor execution of an autorotational landing and low G maneuvers below +.5 Gs.

b. Spike knock will be more prevalent during zero ground run autorotational landings than for sliding autorotational landings and running landings.

c. Spike knock in itself is not hazardous but is an indicator of a condition that could be hazardous. If spike knock is encountered, an entry must be made on the 2408-13 to include the flight conditions under which the spike knock occurred. An inspection will be performed by maintenance personnel before continuing.

d. During landing, starting, and rotor coastdown, spike knock could also occur, especially if there are high winds and/or the elastomeric damper is deteriorated. This type of spike knock is not considered damaging to the aircraft.

8-30. PYLON WHIRL.

Pylon whirl is a condition which occurs after blade flapping and mast bumping. The resultant motion of the pylon is elliptical, and spike knock is apt to occur. If the frequency of motion coincides with a particular natural frequency of the helicopter, and the amplitude and direction of the force is large enough, damaging vibrations can occur in the aft section tailboom of the helicopter. Motion of this type could occur during touchdown autorotations, if operational limits are exceeded.

8-31. CRITICAL TAILBOOM DYNAMIC MODES.

Two critical tailboom dynamic modes exist. One of these may occur during an improperly executed touchdown autorotational landing and corresponds to a frequency of less than 225 main rotor RPM **A**, (64 percent **C**). The second may occur during a high speed autorotational entry, or any maneuver in which application of collective allows a significant decay in RPM down to a critical frequency corresponding to approximately 240-260 main rotor RPM **A**, (68-73 percent **C**). At high blade angles of attack (increased collective), there may be a point where the blade does not produce more lift. When there is this condition of low rotor speeds and high collective blade angles, there will be excessive flapping of the main rotor. The cycle will be as follows: rotor blade flap, mast bumping, and spike knock which, ultimately, results in main rotor inertia/energy transfer to the airframe. These conditions generate a resonance and the tailboom will rapidly respond to these frequencies. The tailboom will then have up and down movements as it responds to the resonant condition and at some point, a structural failure will occur. Typically, there will be wrinkles in the tailboom just aft of the boom attaching points. After the tailboom has buckled and/or been damaged, the vibrations may (and usually will) cease; predominately, because the failure unloads the condition or the landing has stopped or main rotor flapping has ceased. This could be aggravated by high winds and abrupt cyclic inputs while in the condition. High forward speed relative to the maneuver may provide the driving force for excessive blade flapping, mast bumping, and, as a result, damaging vibration. Likelihood of encountering the second mode is remote and is avoidable if operating limitations of the helicopter are observed.

8-32. LOSS OF TAIL ROTOR EFFECTIVENESS.

a. Loss of tail rotor effectiveness (LTE) is the occurrence of an uncommanded and rapid right yaw rate which does not subside of its own accord and which, if not quickly reacted to, can result in loss of aircraft control. However, the term "loss of tail rotor effectiveness" is misleading. The tail rotor on this aircraft has exhibited the capability to produce thrust during all flight regimes. Under varying combinations of wind azimuth and velocity, tail rotor thrust variations can occur. When this occurs, the helicopter will attempt to yaw to the right. This yaw is usually correctable if immediate additional left pedal is applied. Correct and timely pilot response to an uncommanded right yaw is critical. If the response is incorrect or slow, the yaw rate may rapidly increase to a point where recovery may not be possible in the terrain flight regime.

NOTE

The pilot must anticipate these variations, concentrate on flying the aircraft, and not allow a yaw rate to build.

b. Extensive flight testing and wind-tunnel tests have identified three relative wind azimuth regions as capable of adversely affecting aircraft controllability and dramatically increasing pilot workload. Although specific wind azimuths are identified for each region, the pilot must realize the azimuths may shift depending on the ambient conditions. (See figure 8-2.)

(1) Weathercock stability (120-240 degrees). Winds within this region will attempt to weathervane the aircraft into the relative wind. The helicopter exhibits a tendency to make a slow uncommanded yaw to either the left or right, depending upon the exact wind direction. Due to the inherent yaw characteristics of this helicopter, the right yaw rate will increase unless arrested by the pilot. A right yaw can develop into an LTE condition and requires immediate correction.

(2) Vortex ring state (210-330 degrees). Winds within this region will cause a vortex ring state to develop around the tail rotor, which, in turn, causes tail rotor thrust variations. The helicopter exhibits a

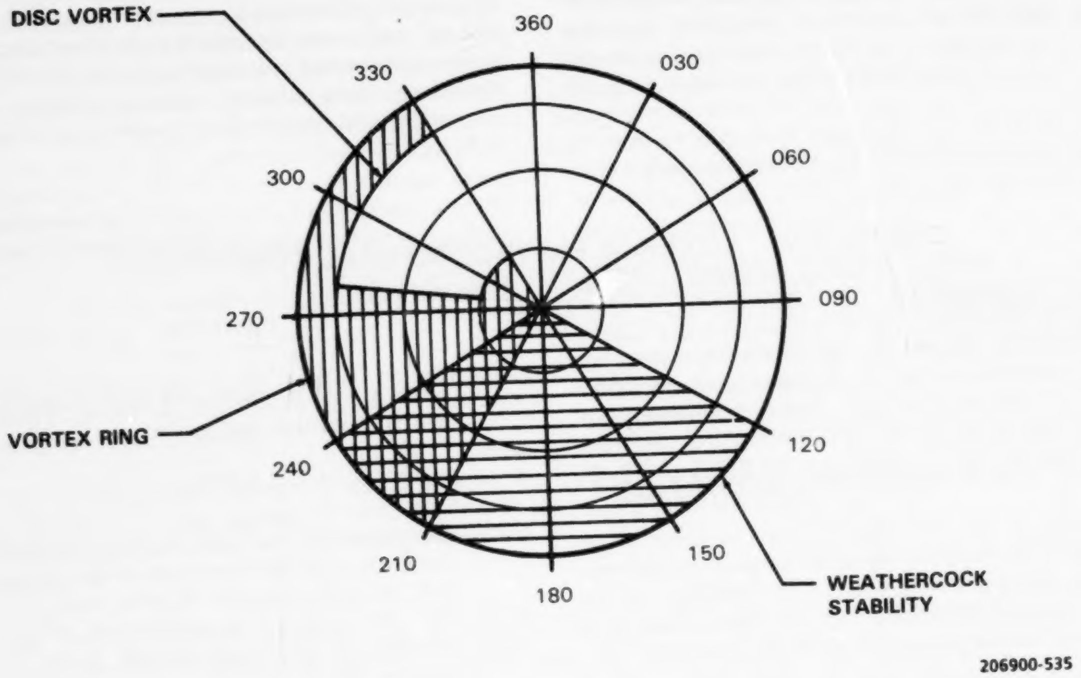


Figure 8-2. Effects of Wind Azimuth On Aircraft

tendency to make uncommanded pitch, roll, and yaw excursions. The subsequent aircraft reactions require multiple pedal, cycle, and collective inputs by the pilot. Maintaining a precise heading in this region will be impossible. Pilot workload in this region will be high; therefore, the pilot must concentrate fully on flying the aircraft and not allow a right yaw rate to build.

(3) Disc vortex (280-330 degrees). Winds within this region will cause the main rotor tip vortices to be directed onto the tail rotor. The effect of this main rotor vortex is to cause the tail rotor to operate in an extremely turbulent environment. The helicopter will exhibit a tendency to make a sudden uncommanded right yaw which, if uncorrected, will develop into a spin. When operating in this region, the pilot must anticipate the sudden demand for left pedal inputs.

c. Other factors which may be present can significantly influence the severity of the onset of LTE. These factors are:

(1) Gross weight and density altitude. An increase in either of these factors will decrease the power margin between the maximum available and power required to hover. The pilot should conduct a low level, low airspeed mission with only minimum essential personnel and equipment on board.

(2) Low indicated airspeed. At airspeeds below LTE, the tail rotor is required to produce nearly 100 percent of the directional control. If the required amount of tail rotor thrust is not available, for whatever reason, the aircraft will yaw to the right.

(3) Power droop. A rapid power application may cause a transient power droop to occur. Any decrease in main rotor RPM will cause a corresponding decrease in tail rotor thrust. The pilot must anticipate this and apply additional left pedal to counter the main rotor torque. All power demands should be made as smoothly as possible to minimize the effect of the power droop.

d. The OH-58A/C, in its typical mission configuration, is closer to its maximum gross weight than most other aircraft in the Army inventory; thus, the pilot is consistently operating closer to power and directional control limits. For this reason, the aircraft heading should be kept into the wind as much as possible; it is very important that precise heading control be maintained to minimize the yaw excursions that could lead to LTE. Additionally, it has been determined that there is a greater susceptibility to LTE for right turns (especially right downwind turns at low altitude and low airspeeds) than for left turns. Therefore, pilot should exercise caution when executing right turns under conditions conducive to LTE.

SECTION V. ADVERSE ENVIRONMENTAL CONDITIONS

8-33. GENERAL.

This section provides information relative to operation under adverse environmental conditions. Section II checklist provides for operational requirements of this section. Refer to FM 1-202, Environmental Flight.

8-34. COLD WEATHER OPERATIONS.

Operation of the helicopter in cold weather or an arctic environment presents no unusual problems if the operators are aware of those changes that do take place and conditions that may exist because of the lower temperatures and freezing moisture.

a. Inspection. The pilot must be more thorough in the preflight check, when temperatures have been at or below 0 degrees C (32 degrees F). Water and snow may have entered many parts during operations or in periods when the helicopter was parked unsheltered. This moisture often remains to form ice which will immobilize moving parts or damage structure by expansion and will occasionally foul electric circuitry. Protective covers afford protection against rain, freezing rain, sleet, and snow, when installed on a dry helicopter prior to the precipitation. Since it is not practicable to completely cover an unsheltered helicopter, those parts not protected by covers and those adjacent to cover overlap and joints require closer attention, especially after blowing snow or freezing rain. Remove accumulation of snow and ice prior to flight. Failure to do so can result in hazardous flight, due to aerodynamic and center-of-gravity disturbances, as well as the introduction of snow, water, and ice into internal moving parts and electrical systems. Pilot should be particularly attentive to the main and tail rotor systems and their exposed control linkages.

b. Checks.

(1) Exterior checks 0 degrees C (32 degrees F) to -54°C (-65°F). Perform exterior check as outlined in Section II plus the following checks.

CAUTION

Check that all surfaces and controls are free of ice and snow.

NOTE

Contraction of the fluids in the helicopter system at extreme low temperature causes indication of low levels. A check made just after the previous shutdown and carried forward to the walk-around check is satisfactory, if no leaks are in evidence. Filling, when the system is cold-soaked, reveals an over full condition immediately after flight, with the possibility of forced leaks at seals.

(a) Main rotor — Check free of ice, frost, and snow.

(b) Engine.

1 Inspect inlet for possible accumulations of snow, slush, or ice. Accumulations must be removed from the interior of the reverse flow inlet (hand removal is acceptable).

2 Inspect the engine plenum chamber through the plexiglass windows (a flashlight may be required) on each side of the inlet cowling for snow, slush, or ice, paying particular attention to the firewalls, rear face of the particle separator, bottom corners, and protruding surfaces, such as guide vanes, etc.

3 Visually inspect the plastic particle separator eductor tubes on each side of the engine fairing for obstructions and snow. A thin film of ice about the interior of each tube is acceptable. External ice, adjacent to the eductor tube, is acceptable.

4 If exhaust covers are missing or improperly installed, rain or snow may enter the engine through the exhaust stacks and subsequently freeze, causing the N1 and N2 turbine blades to be imbedded in ice. If the starter is activated under these circumstances, serious engine damage may result. Visually inspect inside of the exhaust collector (with a flashlight, if necessary) to ensure that no ice is present. Apply external heat to the engine until all visible ice in the exhaust collector is melted, before attempting start.

(c) Oil tank compartment — Check free of ice, frost, and snow.

(2) Interior check — All flights 0 degrees C (32 degrees F) to -43 degrees C (-65 degrees F). Perform check as specified in Section II.

(3) Interior check — Night flights 0 degrees C (32 degrees F) to -54 degrees C (-65 degrees F). External power connected. Perform check as specified in Section II.

(4) Engine starting check -0 degrees C (32 degrees F) to -54 degrees C (-65 degrees F). Perform as outlined in Section II.

NOTE

During cold weather, starting the engine oil pressure gage may exceed 130 PSI. The engine should be warmed up at engine idle until the engine oil pressure indication is below 130 PSI.

(5) Engine runup check. Perform the check as outlined in Section II.

WARNING

Control system checks should be performed with extreme caution when helicopter is parked on snow and ice. There is reduction in ground friction holding the helicopter stationary: controls are sensitive and response is immediate.

c. **Engine Starting Without External Power Supply.** If a battery start must be attempted when the helicopter and battery have been cold-soaked at temperatures between -26 degrees C to -37 degrees C (-15 degrees F to -35 degrees F), preheat the engine and battery, if equipment is available and time permits. Preheating will result in a faster starter cranking speed which tends to reduce the hot-start hazard, by assisting the engine to reach a selfsustaining speed.

d. **Engine Anti-Icing.** The ENG DEICE switch should be in ENG DEICE position in visible moisture below 5 degrees C FAT.

8-35. SNOW OPERATIONS.

There are no unusual flight operational characteristics in snow operations. Refer to FM 1-202, Environmental Flight, for snow takeoff and landing technique.

8-36. DESERT AND HOT WEATHER OPERATIONS.

There are no unusual flight operational characteristics in desert and hot weather operations. Refer to FM 1-202, Environmental Flight, for operational technique.

8-37. TURBULENCE.

a. International flight into moderate turbulence is prohibited when the report is based on aircraft over 12,500 pounds gross weight.

b. Flight into moderate turbulence is permitted, when the report is based on aircraft under 12,500 pounds gross weight.

c. To minimize the adverse effects of turbulence encountered in flight, the helicopter should be flown at a torque value corresponding to maximum endurance airspeed. There will be a corresponding increase in control movements at the reduced airspeed.

d. Helicopter controllability is the primary consideration; therefore, if control becomes marginal, exit the turbulence as soon as possible.

e. In turbulence, check that all occupants are seated with seat belts and harnesses tightened.

8-38. THUNDERSTORMS.

a. To minimize the effects of thunderstorms encountered in flight, perform the following:

(1) Adjust torque to a value corresponding to maximum endurance airspeed.

(2) Check that all occupants are seated with seat belts and harnesses tightened.

(3) PITOT HTR switch — ON.

(4) Avionics — Reduce volume on any equipment affected by static.

(5) Interior lights — Adjust to full bright at night to minimize blinding effect of lightning.

b. In the storm:

(1) Maintain a level attitude and constant power setting. Airspeed fluctuations should be expected and disregarded.

(2) Maintain original heading, turning only when necessary.

(3) The altimeter is unreliable, due to differential barometric pressures within the storm. An indicated gain or loss of several hundred feet is not uncommon and should be allowed for in determining minimum safe altitude.

8-39. LIGHTNING STRIKES.

a. Although the possibility of a lightning strike is remote, the helicopter could inadvertently be exposed to lightning damage. Therefore, static tests have been conducted to determine lightning strike effects on rotors.

b. Simulated lightning tests indicate that lightning strikes may damage helicopter rotors. The degree of damage will depend on the magnitude of the charge and the point of contact. Catastrophic structural failure is not anticipated. However, lightning damage to hub bearings, blade aft section, trim tabs, and blade tips was demonstrated. Also, adhesive bond separations occurred between the blade spar and aft section between the spar and leading edge abrasion strip. Some portions of blade aft sections deformed to the extent that partial or complete separation of the damaged section could be expected. Such damage can aerodynamically produce severe structural vibration and serious control problems which, if prolonged, could endanger the helicopter and crew.

WARNING

Avoid flight in or near thunderstorms, especially in areas of observed or anticipated lightning discharges.

NOTE

Abnormal operating noises almost always accompany rotor damage, but loudness or pitch are not valid indications of the degree of damage sustained.

c. If lightning strike occurs, or is expected, the following precautions are recommended to minimize further risk.

(1) Reduce airspeed as much as practical to maintain safe flight.

(2) Avoid abrupt control inputs.

8-40. ICING CONDITIONS.

a. Intentional flight in any icing condition is prohibited. If icing conditions are encountered during flight, effort should be made to vacate the icing environment.

b. If icing conditions become unavoidable, the pilot should turn on the pitot heat, windshield defroster, and the engine anti-ice system.

c. During flights in icing, the following conditions may be experienced.

(1) Obscured forward field of view due to ice accumulation on the windscreens and chin bubbles. If the windshield defrosters fail to keep the windshield clear of ice, the side windows may be used for visual reference during landing.

(2) One-per-rotor-revolution vibrations, ranging from mild to severe, caused by asymmetrical ice shedding on the main rotor system. The severity of the vibration will depend on the temperatures and the amount of ice accumulation on the blades when the ice shed occurs. The possibility of asymmetric ice shed occurring increases as the outside air temperature decreases.

(3) An increase in torque required to maintain a constant airspeed and altitude due to ice accumulation on the rotor system and possible degradation of the ability to maintain autorotational rotor speed within operating limits.

d. Control activity cannot be depended on to remove ice from the main rotor system. Vigorous control movements should not be made in an attempt to reduce low frequency vibrations caused by asymmetrical shedding of ice from the main rotor blades. These movements may induce a more asymmetrical shedding of ice, further aggravating helicopter vibration levels.

WARNING

Ice shed from the rotor blades and/or other rotating components presents a hazard to personnel during landing and shutdown. Ground personnel should remain well clear of the helicopter during landing and shutdown and passengers/crew members should not exit the aircraft until the rotor has stopped turning.

CHAPTER 9

EMERGENCY PROCEDURES

Section I. HELICOPTER SYSTEMS

9-1. HELICOPTER SYSTEMS.

This section describes the helicopter systems emergencies that may reasonably be expected to occur and presents the procedures to be followed. Emergency operation of mission equipment is contained in this chapter insofar as its use affects safety of flight. Emergency procedures are given in checklist form when applicable. A condensed version of these procedures is contained in the condensed checklist.

9-2. IMMEDIATE ACTION EMERGENCY STEPS.

Those steps that must be performed immediately in an emergency are underlined. These steps must be performed without reference to the checklist. When the situation permits, non-underlined steps will be accomplished with use of the checklist.

NOTE

The urgency of certain emergencies require immediate and instinctive action by the pilot. The most important single consideration is helicopter control. All procedures are subordinate to this requirement.

9-3. DEFINITION OF EMERGENCY TERMS.

For the purpose of standardization, the following definitions shall apply:

a. The term LAND AS SOON AS POSSIBLE is defined as landing to the nearest suitable landing area (e.g., open field) without delay. (The primary consideration is to ensure the survival of occupants.)

b. The term "LAND AS SOON AS PRACTICABLE" is defined as landing at a suitable landing area. (The primary consideration is the urgency of the emergency.)

c. The term AUTOROTATE is defined as adjusting the flight controls as necessary to establish an autorotational descent and landing.

1. Collective — Adjust as required to maintain rotor RPM.
2. Pedals — Adjust, crab or slip as required.
3. Throttle — Adjust. Close as required.
4. Airspeed — Adjust as required.

d. The term EMER SHUTDOWN is defined as engine shutdown without delay.

1. Throttle — Close.
2. Fuel Valve Handle — OFF.
3. BAT switch — OFF. Before turning the battery switch off during in-flight emergencies requiring EMER SHUTDOWN, the pilot should consider a "MAYDAY" call, transponder, emergency, and the possible adverse effects of total electrical failure.

NOTE

Total electrical failure in the OH-58C will result in loss of rotor RPM indications.

9-4. AFTER EMERGENCY ACTION.

After a malfunction of equipment has occurred, appropriate emergency actions have been taken and the helicopter is on the ground, an entry shall be made in the Remarks section of DA Form 2408-13 describing the malfunction. Ground and flight operations shall be discontinued until corrective action has been taken.

9-5. EMERGENCY EQUIPMENT.

A fire extinguisher and first aid kit (figure 9-1) are mounted on the right of the center post behind the pilot seat.

9-6. EMERGENCY EXITS/EMERGENCY ENTRANCE.

Emergency exits are shown in figure 9-1. Emergency jettison handles are yellow. To exit the aircraft in an emergency, first attempt to open doors. If doors will not open, use emergency jettison handles. The crew doors can be jettisoned by pulling the yellow handles to the aft position and the cabin doors by moving the yellow handles to the forward position. If doors will not jettison, break plexiglas to exit the aircraft.

9-7. ENGINE MALFUNCTION — PARTIAL OR COMPLETE POWER LOSS.

a. The indications of an engine malfunction, either a partial or a complete power loss, are: left yaw, drop in engine RPM, drop in rotor RPM, low RPM audio alarm, illumination of the ROTOR RPM warning light, ENGINE OUT warning light, and change in engine noise.

WARNING

Do not respond to the RPM audio and/or warning light illumination without first confirming engine malfunction by one or more of the other indications. Normal indications signify that the engine is functioning properly and that there is a tachometer generator failure or an open circuit to the warning system, rather than an actual engine malfunction.

b. **Flight Characteristics:**

1. Control response with an engine inoperative is similar to a descent with power.

2. Airspeed above the minimum rate of descent from autorotational glide characteristics chart (figure 9-2) will result in greater rates of descent but may be used as necessary to extend glide distance.

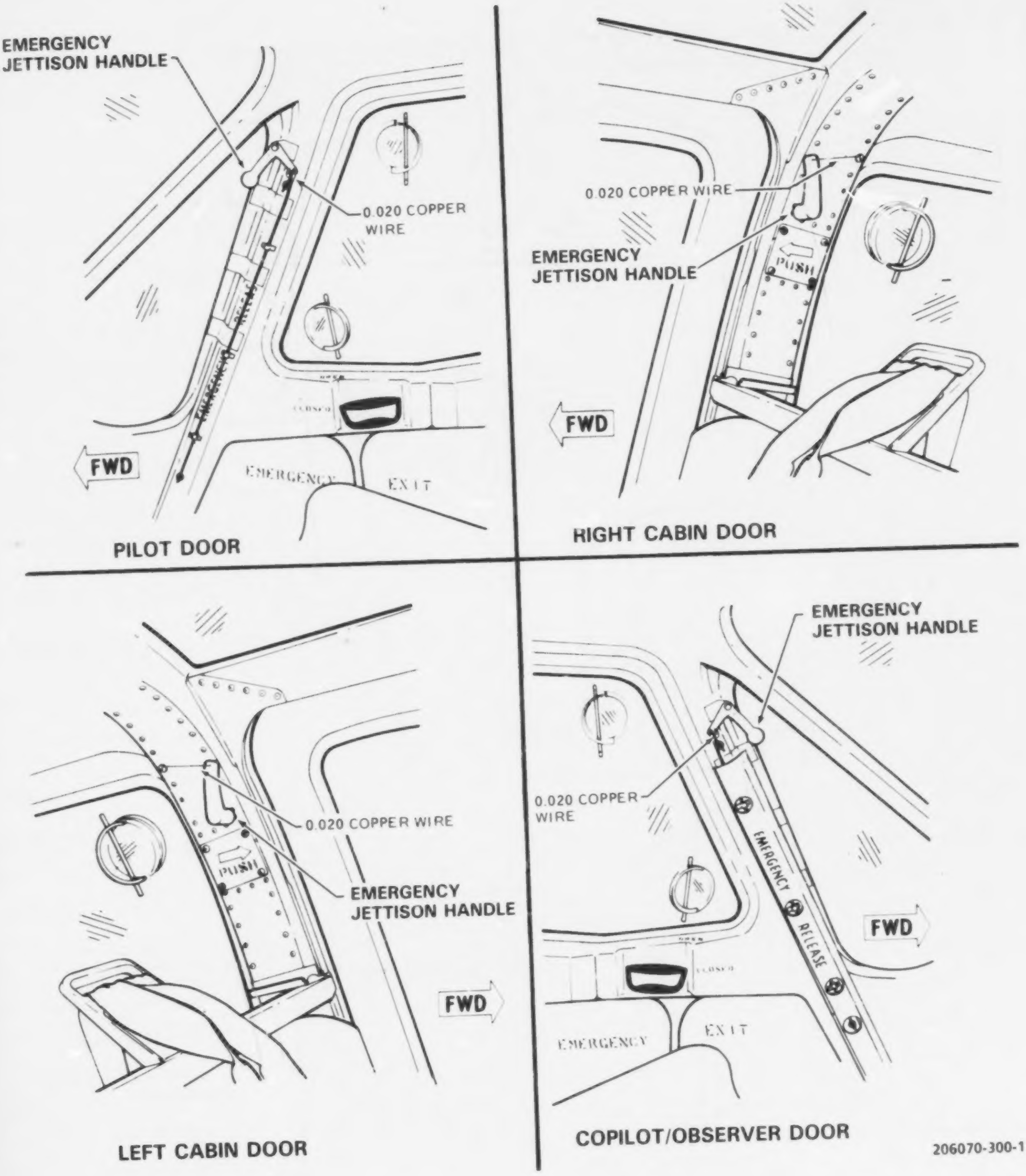
3. Airspeeds below minimum rate of descent airspeeds will increase rate of descent and decrease glide distance.

4. Should the engine malfunction during a left bank maneuver, right cyclic input to level the aircraft must be made simultaneously with collective pitch adjustment. If the collective pitch is decreased without a corresponding right cyclic input, the helicopter will pitch down and the roll rate will increase rapidly, resulting in a significant loss of altitude.

c. **Partial Power Condition.** Under partial power conditions, the engine may operate smoothly at reduced power or it may operate erratically with intermittent surges of power. In instances where a power loss is experienced without accompanying power surging, the helicopter may be flown at reduced power to a suitable landing area. Under this condition, the pilot should always be prepared for a complete power loss. In the event a partial power condition is accompanied by erratic engine operation or power surging, and flight is to be continued, the throttle may be adjusted in an attempt to correct the surging condition. If flight is not possible, close the throttle completely and complete an autorotational landing.

d. **Complete Power Loss.** Under a complete power loss condition, delay in recognition of the malfunction, improper technique or excessive maneuvering to reach a suitable landing area reduces the probability of a safe autorotational landing. Flight conducted within the avoid area of the chart (figure 9-3) exposes the helicopter to a high probability of damage despite the best efforts of the pilot.

e. **Low Airspeed and Low Altitude.** Under low altitude low airspeed conditions, the deceleration capability is limited, and caution should be used to avoid striking the ground with the tail rotor. Initial collective reduction will vary after an engine malfunction, dependent upon the altitude and airspeed at the time of the occurrence. For example, collective should not be decreased when an engine failure occurs at a hover below 15 feet; whereas, during cruise flight conditions, altitude and airspeed are sufficient for a significant reduction in collective, thereby, allowing rotor RPM to be maintained in the safe operating range during autorotational descent. The rotor may overspeed and require collective pitch application to maintain the RPM below the upper limit. Collective should never be applied to reduce


EMERGENCY JETTISON HANDLE
0.020 COPPER WIRE
EMERGENCY RELEASE
CLOSED
EMERGENCY EXIT
FWD
0.020 COPPER WIRE
EMERGENCY JETTISON HANDLE
PUSH
FWD
0.020 COPPER WIRE
PUSH
EMERGENCY JETTISON HANDLE
FWD
EMERGENCY JETTISON HANDLE
0.020 COPPER WIRE
EMERGENCY RELEASE
OPEN
CLOSED
FWD
EMERGENCY EXIT
206070-300-1

PILOT DOOR

RIGHT CABIN DOOR

LEFT CABIN DOOR

COPILOT/OBSERVER DOOR

Figure 9-1. Emergency Exits and Equipment (Sheet 1 of 2)

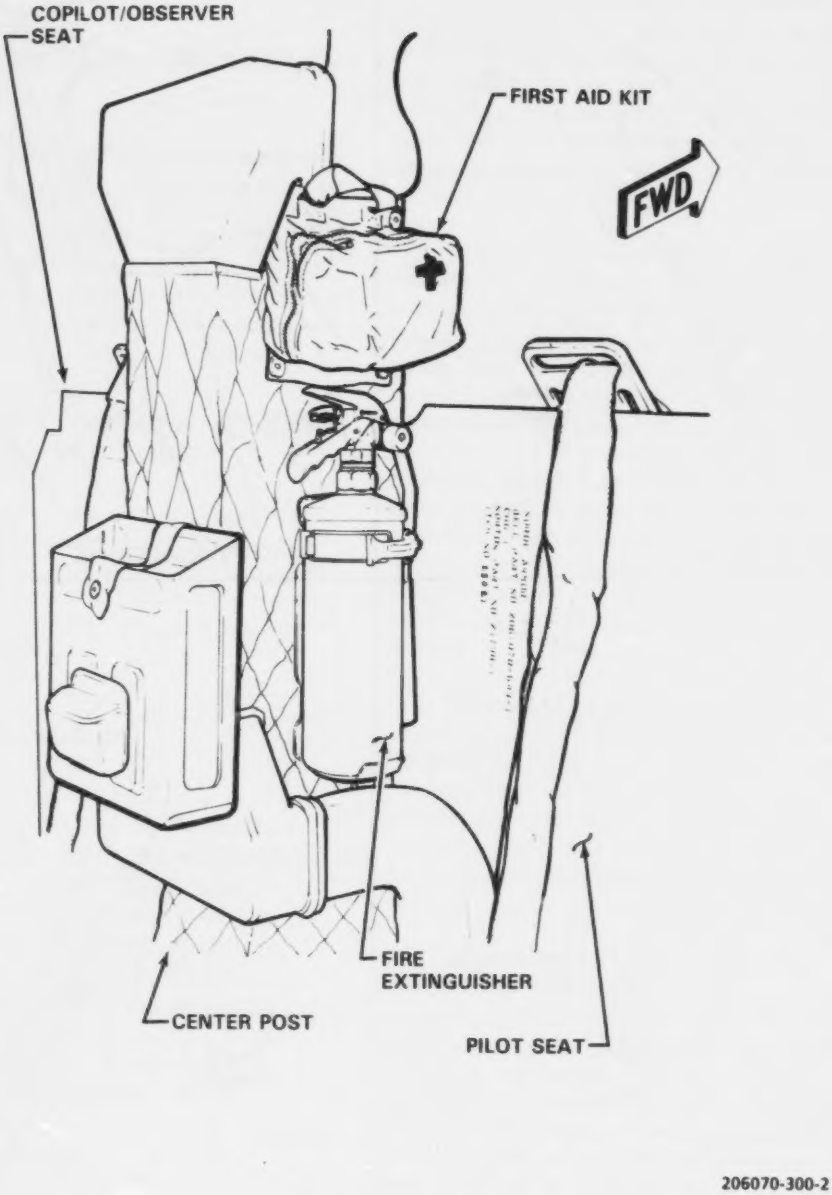

COPILOT/OBSERVER SEAT
FIRST AID KIT
FWD
FIRE EXTINGUISHER
CENTER POST
PILOT SEAT
206070-300-2

Figure 9-1. Emergency Exits and Equipment (Sheet 2 of 2)

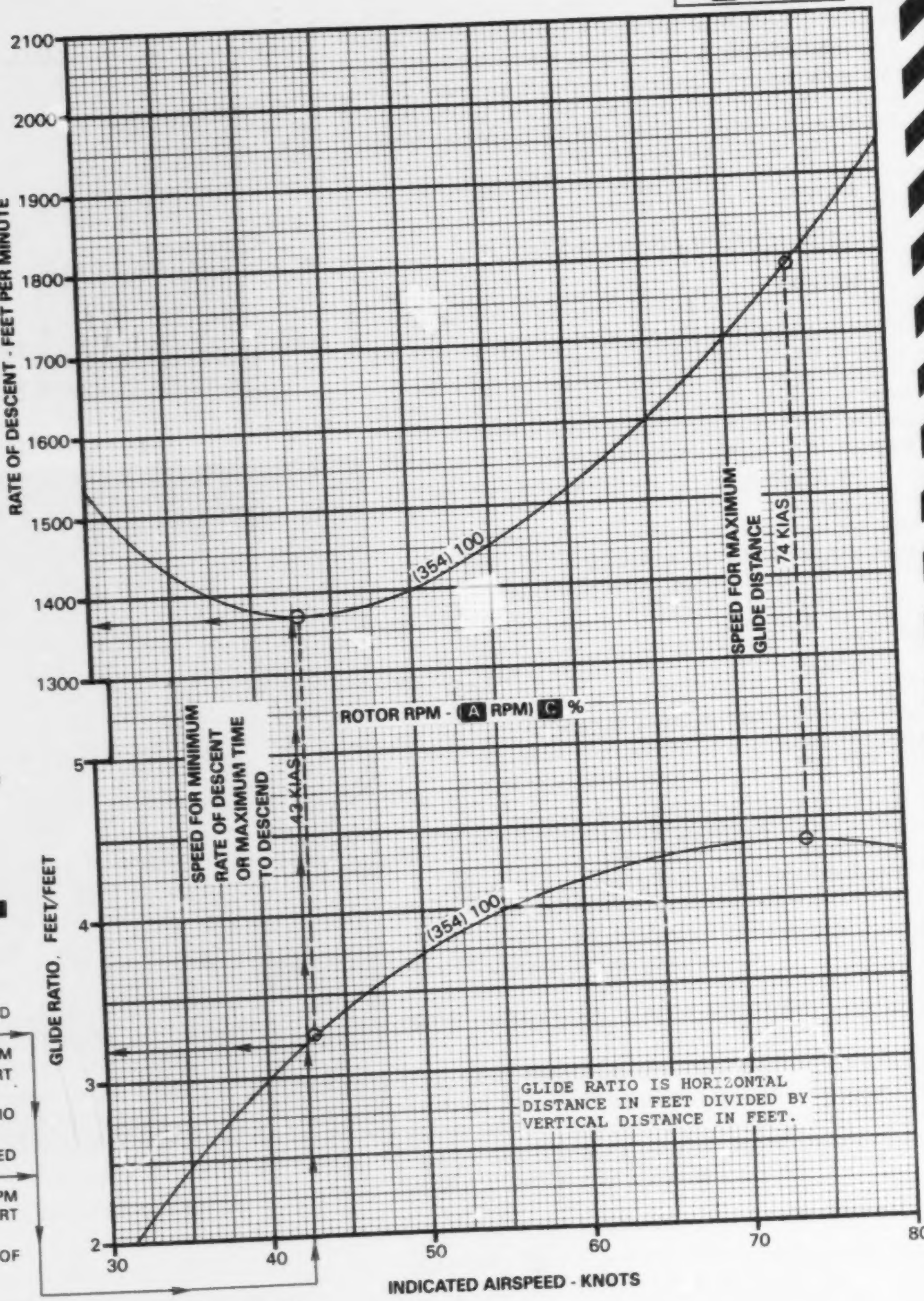
AUTOROTATIONAL GLIDE CHARACTERISTICS

POWER OFF

AUTOROTATIONAL GLIDE
A OH-58A
C OH-58C

NOTE

AUTOROTATIONAL GLIDE PERFORMANCE IS A FUNCTION OF AIRSPEED AND IS ESSENTIALLY UNAFFECTED BY DENSITY ALTITUDE AND GROSS WEIGHT



GLIDE RATIO IS HORIZONTAL DISTANCE IN FEET DIVIDED BY VERTICAL DISTANCE IN FEET.

EXAMPLE

WANTED

GLIDE RATIO AND RATE OF DESCENT

KNOWN

AIRSPEED = 42.5 KIAS
ROTOR RPM = A 354 OR C 100%

METHOD

ENTER INDICATED AIRSPEED HERE ⟶
MOVE UP TO 354 ROTOR RPM GUIDE LINE IN THE LOWER PART OF THE CHART
MOVE LEFT, READ GLIDE RATIO = 3.2
RE-ENTER INDICATED AIRSPEED HERE ⟶
MOVE UP TO 354 ROTOR RPM GUIDE LINE IN THE UPPER PART OF THE CHART
MOVE LEFT, READ RATE OF DESCENT = 1370 FPM

DATA BASIS: DERIVED FROM FLIGHT TEST (USAASTA 68-30)

Figure 9-2. Autorotational glide characteristics chart

MINIMUM HEIGHT FOR SAFE LANDING AFTER ENGINE FAILURE

MINIMUM HEIGHT OH-58A/C

EXAMPLE A

WANTED

MAXIMUM GROSS WEIGHT RESTRICTION FOR SAFE LANDING AFTER ENGINE FAILURE

KNOWN

DENSITY ALTITUDE = 5700 FEET

METHOD

ENTER DENSITY ALTITUDE HERE
MOVE RIGHT TO DIAGONAL LINE
MOVE DOWN, READ GROSS WEIGHT = 2800 LBS

EXAMPLE B

WANTED

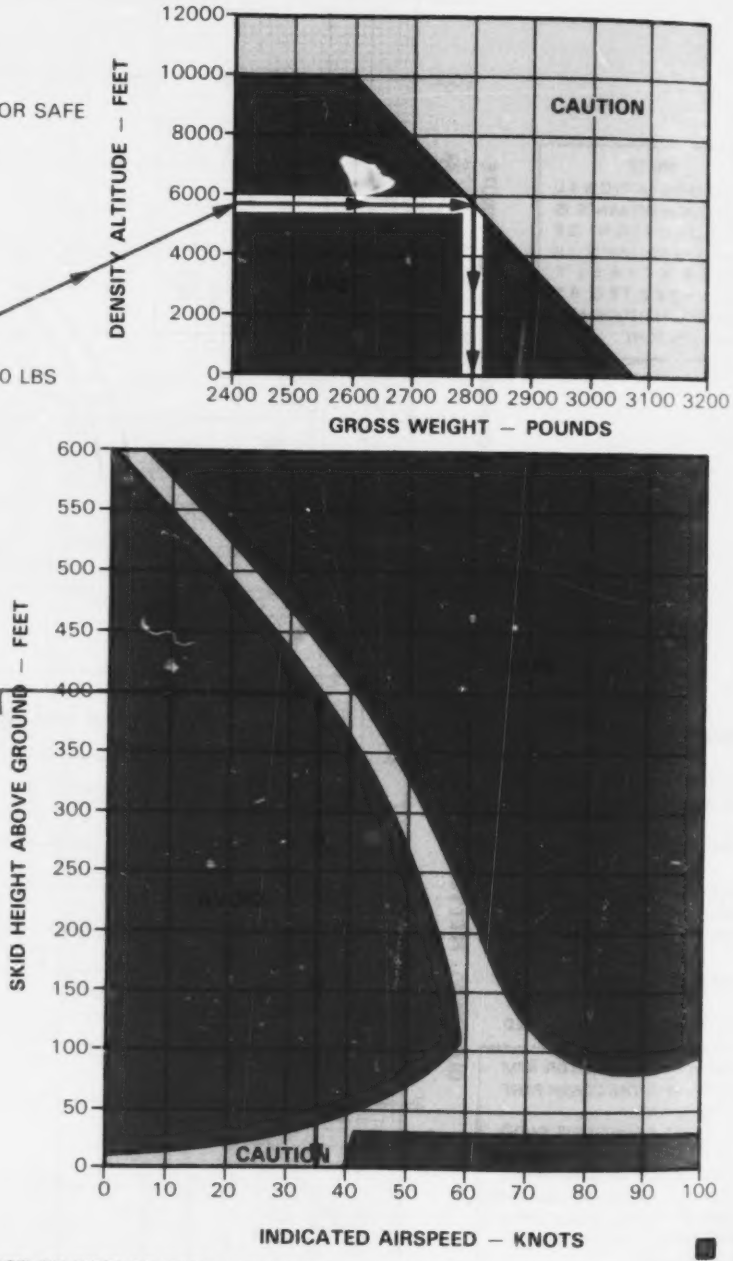
MINIMUM INDICATED AIRSPEED FOR SAFE LANDING (WITHOUT AIRCRAFT DAMAGE) AFTER ENGINE FAILURE

KNOWN

SKID HEIGHT ABOVE GROUND = 400 FEET

METHOD

ENTER SKID HEIGHT HERE
MOVE RIGHT TO CRITICAL POINT ON HEIGHT VELOCITY CURVE
MOVE DOWN, READ INDICATED AIRSPEED = 35 KNOTS (MINIMUM)



DATA BASIS: DERIVED FROM FLIGHT TEST OF SIMILAR TYPE AIRCRAFT

Figure 9-3. Minimum Height for Safe Landing After Engine Failure Chart

RPM below normal limits for extending glide distance because of the reduction in RPM available for use during autorotational landing.

9-8. MINIMUM RATE OF DESCENT — POWER OFF.

The power-off minimum rate of descent is attained at an indicated airspeed of 43 knots and 354 A, (100% C) rotor RPM. Refer to figure 9-2, autorotational glide characteristics chart.

9-9. MAXIMUM GLIDE DISTANCE — POWER OFF.

The maximum glide distance is attained at an indicated airspeed of 71 knots and 354 A, (100% C) rotor RPM. Refer to figure 9-2 for maximum glide distance.

9-10. ENGINE FAILURE — HOVER.

1. Autorotate.

9-11. ENGINE FAILURE — LOW ALTITUDE/LOW AIRSPEED OR CRUISE.

1. Autorotate.
2. EMER SHUTDOWN. Accomplish during descent if time permits.

9-12. ENGINE RESTART — DURING FLIGHT.

After an engine failure in flight, an engine start may be attempted. Because the exact cause of engine failure cannot be determined in flight, the decision to attempt the start will depend on the altitude and time available, rate of descent, potential landing areas, and crew assistance available. Under ideal conditions, approximately one minute is required to regain powered flight from the time the attempted start is begun. If the decision is made to attempt an in-flight start:

1. Throttle — Close.
2. Attempt start.
3. Land as soon as possible.

9-13. ENGINE COMPRESSOR STALL.

Engine compressor stall may be characterized by a sharp rumble or a series of loud sharp reports, severe engine vibration and a rapid rise in TOT depending on the severity of the surge. After engine compressor stall, maneuvers requiring rapid or maximum power applications should be avoided. Should engine compressor stall occur:

1. Collective — Reduce.
2. ENG DEICE and HTR switches — OFF.
3. Land as soon as possible.

9-14. ENGINE OVERSPEED.

Engine overspeed will be indicated by a right yaw, rapid increase in both rotor and engine RPM, and an increase in engine and rotor noise. If an engine overspeed is experienced:

1. Collective — Increase to load the rotor and sustain engine/rotor RPM below the maximum operating limit.
2. Throttle — Adjust until normal operating RPM is attained.
3. Land as soon as possible. Perform a power-on approach and landing by controlling the RPM manually with throttle.

If RPM cannot be controlled manually:

4. Autorotate when over a safe landing area.
5. EMER SHUTDOWN. Accomplish during descent if time permits.

9-15. ENGINE UNDERSPEED.

a. If an engine underspeed occurs, the collective must be adjusted downward to maintain rotor RPM within limits. If powered flight with rotor in the green can be accomplished, land as soon as possible in an area that will permit a run-on landing.

b. An engine underspeed below 97% N2 A (94% N2 C) results in rotor RPM decay below minimum safe limits. Should this occur:

1. Autorotate.

2. EMER SHUTDOWN. Accomplish during descent, if time permits.

9-16. ENGINE SURGES.

If surges in engine RPM are experienced:

1. GOV INCR switch — INCR for maximum RPM.
2. Throttle — Adjust to 100% N2 **A**, (98% N2 **C**).
3. Land as soon as possible.

If engine surges are not controlled in steps 1 and 2 above, proceed as follows:

4. Autorotate — when over safe landing area.
5. EMER SHUTDOWN. Accomplish during descent if time permits.

9-17. ROTORS, TRANSMISSION, AND DRIVE SYSTEMS MALFUNCTIONS.

9-18. TAIL ROTOR FAILURE AND DIRECTIONAL CONTROL MALFUNCTIONS.

Because of the many different malfunctins that can occur, it is not possible to provide a solution for every emergency. The success in coping with the emergency depends on quick analysis of the condition and selection of the proper emergency procedure. The following is a discussion of some types of malfunctions, probable effects, and corrective actions.

9-19. COMPLETE LOSS OF TAIL ROTOR THRUST.

This situation involves a break in the drive system, such as a severed driveshaft, causing the tail rotor to lose power.

a. Powered flight.

(1) **Indications:**

(a) Pedal input has no effect on helicopter trim.

(b) Nose of the helicopter turns to the right (left sideslip).

(c) Left roll of fuselage along the longitudinal axis.

NOTE

Degree of roll and sideslip may be varied by varying throttle and/or collective. (At airspeeds below 40 knots, the sideslip may become uncontrollable, and the helicopter will begin to spin on the vertical axis.)

(2) **Procedures:**

(a) If safe landing area is not immediately available, continue powered flight to suitable landing area at or above minimum rate of descent autorotational airspeed.

(b) When landing area is reached, make an autorotative landing.

(c) Use airspeed above minimum rate of descent airspeed.

(d) If landing area is suitable for run-on landing, touch down above effective translational lift.

(e) If run-on landing is not possible, start to decelerate from about 75 feet altitude, so that forward ground speed is at a minimum when the helicopter reaches 10 to 20 feet. Execute the touchdown with a rapid collective pull just prior to touchdown in a level attitude with minimum ground speed.

b. Power off. (Autorotation).

(1) **Indication.** Pedal input has no effect on trim.

(2) **Procedures:**

(a) Maintain airspeed above minimum rate of descent airspeed.

(b) If run-on landing is possible, complete autorotation with a touchdown airspeed above effective translational lift.

(c) If run-on landing is not possible, start to decelerate from about 75 feet altitude, so that forward groundspeed is at a minimum when the helicopter reaches 10 to 20 feet; execute the touchdown with a rapid collective pull just prior to touchdown in a level attitude with minimum ground speed.

9-20. FIXED PITCH SETTINGS.

This is a malfunction involving a loss of control resulting in a fixed pitch setting. Whether the nose of the helicopter yaws left or right is dependent upon the amount of pedal applied at the time of the malfunction. Regardless of pedal setting at the time of malfunction, a varying amount of tail rotor thrust will be delivered at all times during flight.

a. Reduced power (low torque).

(1) **Indications:** The nose of the helicopter will turn right when power is applied.

(2) **Procedure:**

(a) If helicopter control can be maintained in powered flight, the best solution is to maintain control with power and accomplish a run-on landing as soon as practicable.

(b) If helicopter control cannot be maintained, close the throttle immediately and accomplish an autorotational landing.

b. Increased power (high torque).

(1) **Indications:** The nose of the helicopter will turn left when power is reduced.

(2) **Procedure:**

(a) Maintain control with power and airspeed. (Between 40 and 70 knots.)

(b) If needed, reduce engine RPM manually to 101% A, (98% C).

(c) Continue powered flight to a suitable landing area where a run-on landing can be accomplished.

(d) Execute a run-on landing with power and a touchdown speed which will minimize sideslip. Use throttle and collective, as necessary, to control sideslip and heading.

c. Hover.

(1) **Indication:** Helicopter heading cannot be controlled with pedals.

(2) **Procedure.**

(a) Fixed pedal — Land.

(b) Loss of tail rotor thrust — Perform hovering autorotation.

9-21. LOSS OF TAIL ROTOR COMPONENTS.

The severity of this situation is dependent upon the amount of weight lost. Any loss of this nature will result in a forward center of gravity shift, requiring aft cyclic.

a. Indications:

(1) Varying degrees of right yaw depending on power applied and airspeed at time of failure.

(2) Forward CG shift.

b. Procedure:

(1) Enter autorotative descent (power off).

(2) Maintain airspeed above minimum rate of descent airspeed.

(3) If run-on landing is possible, complete autorotation with a touchdown airspeed above effective translational lift.

(4) If run-on landing is not possible, start to decelerate from about 75 feet altitude, so that forward groundspeed is at a minimum when the helicopter reaches 10 to 20 feet; execute the touchdown with a rapid collective pull just prior to touchdown in a level attitude with minimum ground run.

9-22. LOSS OF TAIL ROTOR EFFECTIVENESS (LTE).

This is a situation involving a loss of effective tail rotor thrust without a break in the drive system which cannot be stopped with full left pedal application. If LTE is experienced, simultaneously:

1. Pedal — Full Left.
2. Cyclic — Forward.
3. As recovery is effected, adjust controls for normal flight.

WARNING

Collective reduction will aid in arresting the yaw rate; however, if a rate of descent has been established, collective reduction may increase the rate of descent to an excessive value. The resultant large and rapid increase in collective to prevent ground or obstacle contact may further increase the yaw rate, decrease the rotor RPM and cause an overtorque and/or over-temperature condition. Therefore, the decision to reduce collective must be based on the pilot assessment of the altitude available for recovery.

If spin cannot be stopped and crash is imminent, an autorotation may be the best course of action. Maintain full left pedal until the spin stops, then adjust to maintain heading.

9-23. MAIN DRIVESHAFT FAILURE.

A failure of the main driveshaft will be indicated by a sudden increase in engine RPM, decrease in rotor RPM, left yaw and activation of the low RPM audio, and illumination of the ROTOR RPM warning light. A transient overspeed of N1 and N2 may occur but will stabilize. In the event of main driveshaft failure:

1. AUTOROTATE — Establish a power-on autorotational glide. The engine must continue to operate in order to provide tail rotor control.
2. EMER SHUTDOWN after landing.

9-24. CLUTCH FAILS TO DISENGAGE.

A clutch failing to disengage in flight will be indicated by the rotor RPM decaying with engine RPM as the throttle is reduced to the engine idle position when entering autorotational descent. This condition results in total loss of autorotational capability. If a failure occurs:

1. Throttle — Open.
2. Land as soon as possible.

9-25. MAST BUMPING.

Land as soon as possible.

9-26. FIRE.

The safety of helicopter occupants is the primary consideration when a fire occurs; therefore, it is imperative that every effort be made by the flight crew to put the fire out. On the ground, it is essential that the engine be shut down, crew and passengers evacuated and fire fighting begun immediately. If time permits, a "MAYDAY" radio call should be made before the electrical power is off to expedite assistance from fire fighting equipment and personnel. If the helicopter is airborne when a fire occurs, the most important single action that can be taken by the pilot is to land the helicopter.

WARNING

Toxic fumes of the extinguishing agent may cause injury, and liquid agent may cause frostbite or low temperature burns.

CAUTION

If aircraft fire occurs on ground while using Ground Power Unit (GPU); the GPU should be shutdown immediately.

9-27. HOT START.

CAUTION

During engine starts using a Ground Power Unit (GPU), failure of the GPU could possibly result in an engine hot start. After GPU failure during start, the pilot must turn the battery switch on before accomplishing the procedure described below.

During engine starting or shutdown, if TOT limits are exceeded, or it becomes apparent that TOT limits may be exceeded.

1. STARTER switch — Press until TOT is less than 200°C.

2. Throttle — Close.

9-28. ENGINE/FUSELAGE/ELECTRICAL FIRE — GROUND.

EMER SHUTDOWN.

9-29. ENGINE/FUSELAGE FIRE — IN FLIGHT.

If a fire is observed during flight, prevailing circumstances such as VMC, IMC, night, altitude, and landing areas available must be considered in order to determine whether to execute a power-on, or power-off landing.

If Power-On landing:

1. Land as soon as possible.

2. EMER SHUTDOWN after landing.

If Power-Off landing:

1. Autorotate.

2. EMER SHUTDOWN. Accomplish during descent if time permits.

9-30. ELECTRICAL FIRE — FLIGHT.

Prior to shutting off all electrical power, the pilot must consider the equipment that is essential to a particular flight environment that will be encountered. In the event of electrical fire or suspected electrical fire in flight:

1. BAT and GEN switches — OFF.

2. Land as soon as possible.

3. EMER SHUTDOWN after landing.

9-31. SMOKE AND FUME ELIMINATION.

Smoke and/or toxic fumes entering the cockpit and cabin can be exhausted as follows:

CAUTION

Do not jettison doors in flight above effective translational lift.

1. Vents — Open.

2. DEFOG & VENT switch — ON.

9-32. ELECTRICAL SYSTEM MALFUNCTIONS.

9-33. GENERATOR FAILURE — NO OUTPUT.

A no-output malfunction of the generator will be indicated by a zero indication on the DC AMMETER and a DC GENERATOR caution light illumination. An attempt may be made to put the generator back on line by accomplishing the following:

1. GEN FIELD, GEN & BUS RESET circuit breaker — Check IN.

2. GEN switch — RESET then GEN — Do not hold the switch in the RESET position.

If the generator is not restored, or if it goes off the line again:

3. GEN switch — OFF.

4. Turn OFF all unnecessary electrical equipment.

5. Land as soon as practicable.

9-34. OVERHEATED BATTERY.

An abnormally high DC AMMETER indication is evidence of a high battery charging rate or a battery thermal runaway. High battery charging amperage is normal immediately after engine start and should dissipate within minutes. DC AMMETER indication of 30 AMPS or below is normal after 15 minutes of aircraft operation with all systems operating.

WARNING

Do not open battery compartment or attempt to disconnect or remove overheated battery. Battery fluid will cause burns and overheated battery will cause thermal burns and may explode.

If high DC amperage does not dissipate:

1. BAT Switch — OFF.

If high DC amperage indication disappears with BAT switch OFF, a high battery charging rate and possible battery thermal runaway is confirmed, in this event:

2. Land as soon as possible.
3. EMER SHUTDOWN after landing.

If high DC amperage indication does not dissipate, pilot should anticipate electrical fire in flight.

9-35. HYDRAULIC SYSTEM MALFUNCTION.

9-36. HYDRAULIC POWER FAILURE.

Hydraulic power failure will be evident when the force required for control movement increases; a moderate feedback in the cyclic and collective controls is felt and the HYD PRESS caution light illuminates. Control movements will result in normal aircraft response in every respect. In the event of hydraulic power failure:

1. Airspeed — Adjust as necessary to attain the most comfortable level of control movements.
2. HYD BOOST SOL circuit breaker — Out; check for restoration of hydraulic power.

If hydraulic power is not restored:

3. HYD BOOST SOL circuit breaker — In.
4. HYD BOOST switch — OFF.

WARNING

Do not return the HYD BOOST switch to the ON position for the remainder of the flight. This prevents any possibility of a surge in hydraulic pressure and the resulting loss of control.

5. Land as soon as practicable at an area that will permit a run-on landing.

9-37. LANDING AND DITCHING.

9-38. LANDING IN TREES.

A landing in trees should be made when no other landing area is available. In addition to accomplishing engine malfunction emergency procedures, select a landing area containing the least number of trees of minimum height. Decelerate to minimum forward speed at treetop level and descend into the trees vertically. Apply all of the remaining collective, prior to the main rotor blades entering the trees.

9-39. DITCHING — POWER ON.

If ditching becomes necessary, with power available accomplish an approach to a hover above the water and:

1. Doors — Jettison at a hover.
2. Crew (except pilot) and passengers — Exit.
3. Hover a safe distance away from personnel.
4. Autorotate. Apply all remaining collective as the helicopter enters the water. Maintain a level attitude as the helicopter sinks and until it begins to roll, then apply cyclic in direction of the roll.
5. Pilot — Exit when the main rotor stops.

9-40. DITCHING — POWER OFF.

If an engine failure occurs over water and ditching is imminent, accomplish engine failure emergency procedures and proceed as follows:

1. AUTOROTATE. Decelerate to minimum forward speed as the helicopter nears the

water. Apply all remaining collective as the helicopter enters the water. Maintain a level attitude as the helicopter sinks and until it begins to roll, then apply cyclic in the direction of the roll.

2. Doors — Jettison.
3. Crew and passengers — Exit when the main rotor stops.

9-41. FLIGHT CONTROL MALFUNCTIONS.

Failure of components within the flight control system may be indicated through varying degrees of feedback, binding, resistance, or sloppiness. These conditions should not be mistaken for hydraulic power failure. In the event of a flight control malfunction:

1. Land as soon as possible.
2. EMER SHUTDOWN after landing.

9-42. LIGHTNING STRIKE.

Land as soon as possible.

9-43. IN-FLIGHT WIRE STRIKE.

Land as soon as possible.

SECTION II. MISSION EQUIPMENT

9-44. ARMAMENT A.

If gun fails to fire, proceed as follows:

1. ARMT PWR and ARMT circuit breakers — IN.
2. MASTER switch — FIRE NORM.
3. ARMED-SAFE switch — ARMED.
4. Trigger switch — Lift guard and press. If gun fails to fire, release trigger switch.
5. MASTER switch — FIRE TO CLEAR.
6. Trigger switch — Lift guard and press. Press trigger to both low-rate and high-rate position. If gun fails to fire, release trigger switch.
7. ARMED-SAFE switch — SAFE.
8. MASTER switch — OFF.
9. ARMT PWR and ARMT circuit breakers — OUT.

WARNING

Upon landing, immediately alert personnel to probable presence of live rounds in gun. Any rotation of the gun barrels will cause the gun to fire. Summon armament repairman to clear weapon.

If runaway gun, proceed as follows:

1. ARMED-SAFE switch — SAFE.
2. MASTER switch — OFF.
3. ARMT PWR and ARMT circuit breakers — OUT.

WARNING

Do not respond to warning or caution light illumination without confirming malfunction by other indications if available.

Table 9-1. Warning/Caution Panel Lights

WARNING LIGHT	CORRECTIVE ACTION
ROTOR RPM (Red)	Verify condition. Adjust collective.
MASTER CAUTION	Check for Caution Panel segment light illumination. If none, land as soon as possible.
ENGINE OUT (Red)	Verify condition. Autorotate
XMSN OIL PRESS (Red)	Land as soon as possible.
XMSN OIL HOT (Red)	Land as soon as possible.
CAUTION LIGHT	**CORRECTIVE ACTION**
FUEL BOOST	Land as soon as practicable.
20 MIN FUEL	Information/system status.
FUEL FILTER	Land as soon as possible.
ENG OIL BYPASS	Land as soon as possible.
ENG CHIP DET	Land as soon as possible.
XMSN CHIP DET	Land as soon as possible.
T/R CHIP DET	Land as soon as possible.
INST INVERTER	Information/system status.
DC GENERATOR	Refer to emergency procedures.
HYD PRESS	Refer to emergency procedures.
IFF	Information/system status.

APPENDIX A
REFERENCES

The following references of the issue in effect at the date of this publication are required for use by the operator in performance of his duties

AR 95-1	Army Aviation General Provisions and Flight Regulations
AR 95-16	Weight and Balance Army Aircraft
AR 95-27	Operational Procedures for Aircraft Carrying Dangerous Materials
AR 385-25	Studies and Review, Nuclear Weapons Systems Operational Study Program
AR 385-40	Accident Reporting and Records
DA PAM 310-7	US Army Equipment Index of Modification Work Orders
DA PAM 738-751	Functional Users Manual for the Army Maintenance Management System-Aviation (TAMMS-A)
FM 1-202	Environmental Flight
FM 1-203	Fundamentals of Flight
FM 1-230	Meterology for Army Aviators
FM 1-240	Instrument Flying and Navigation for Army Aviators
FM 10-68	Aircraft Refueling
TB MED 501	Noise and Conservation of Hearing
TB 55 1500-314-25	Handling, Storage and Disposal of Self-Luminous Aircraft Instrument and Markers and Aircraft Engine Ignition Exiciter Units Containing Radio Active Material
TB 55-9150-200-24	Engine and Transmission Oils, Fuels and Additives for Army Aircraft
TM 3-220	Chemical, Biological, and Radiological (CBR) Decontamination
TM 9-1005-298-12	Armament Subsystem, Helicopter, 7.62 Millimeter Machine Gun, High Rate, M27E1 (NSN 1005-00-933-6242) (Used on OH-6A Helicopter)
TM 11-5810-262-OP	Operators Manual, Voice Security Equipment TSEC/KY-58
TM 36-250	Preparation of Hazardous Materials for Military Air Shipment
TM 55-1500-328-25	Aeronautical Equipment Maintenance Management Policies and Procedures
TM 55-1500-342-23	Army Aviation Maintenance Engineering Manual — Weight and Balance
TM 57-220	Technical Training for Parachutists
TM 750-244-1-5	Procedure for the Destruction of Aircraft and Associated Equipment to Prevent Enemy Use

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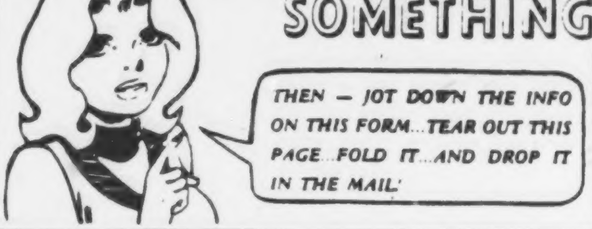
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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C